



# Journal of the Society of Chemical Industry.

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## Official Notices.

### PORTRAIT OF MR. C. F. CROSS.

There has been considerable delay in receiving an adequate supply of the portrait of Mr. C. F. Cross, recipient of the Society's Medal, which was inserted in some copies of the November 30th issue of the Journal, and it has therefore been necessary to postpone the distribution of the remainder of these.

### REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY.

The first volume of the Reports of the Progress of Applied Chemistry is now in active preparation, and will, it is hoped, be published shortly. It will cover recent progress to the end of June, 1916. The second volume will deal with the period up to the end of 1917, and subsequently it is proposed to issue the Reports annually.

The Reports will present a critical summary of the progress that has been made in the various branches of chemical industry during the period in question. It has not been found practicable to treat every section of the Journal classification. Agricultural chemistry, the chemistry of foods, and analysis are fully dealt with in the admirable series of Reports issued annually by the Chemical Society, and for the present there will be no sections on general plant and explosives.

The following is a list of the subjects which will be dealt with, together with the names of the experts who are contributing to this volume:—

- Fuel*—J. W. Cobb.
- Gas, destructive distillation, tar products*—E. V. Evans.
- Mineral oils*—A. W. Eastlake.
- Colouring matters and dyes*—G. T. Morgan.
- Fibres, paper, dyeing, printing*—Julius Huebner.
- Acids, alkalis, salts, etc.*—H. A. Auden.
- Glass, ceramics, cement, etc.*—J. A. Audley.
- Metals, metallurgy*—W. R. E. Hodgkinson.
- Electro-chemistry*—J. T. Barker.
- Fats, oils, waxes*—G. H. Warburton.
- Paints, pigments, varnishes, resins*—R. S. Morrell.
- Indiarubber*—H. P. Stevens.
- Leather, glue, etc.*—J. T. Wood.
- Sugar, starches*—J. G. Macintosh.
- Fermentation*—A. R. Ling.
- Sanitation, water purification*—F. R. O'Shaughnessy.
- Fine chemicals, medicinal substances, essential oils*—F. L. Pyman.
- Photographic materials and processes*—B. V. Storr.

The price of issue will be, to members, 2s. 6d. (plus 6d. postage), and non-members, 5s. (plus 6d. postage). As the issue is to be a limited one, those desirous of securing copies are requested to fill in the order form attached to the cover of the Journal, and return it to the Secretary at an early date.

## London Section.

Meeting held at Burlington House on Monday, November 20th, 1916.

MR. ARTHUR R. LING IN THE CHAIR.

The CHAIRMAN, in opening the meeting, referred in feeling terms to the loss of two past Presidents of the Society, Sir William Ramsay and Mr. David Howard.

Mr. TYRER also paid a tribute to the memory of Mr. Howard.

### CHEMISTRY AND ENGINEERING.

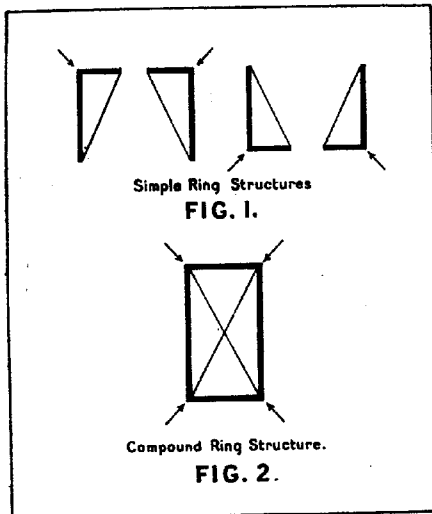
BY DR. CHARLES CARPENTER.

I propose to initiate a talk about Chemists and Engineers and their relationship to the great problem of bringing up to date our national Chemical Industries. The Charter of the Institution of Civil Engineers defines the profession of the engineer as being the art of directing the great sources of power in Nature for the use and convenience of man. We might in similar language define the aim of the chemist as being to wrest from Nature some of her most hidden secrets for the same purpose. (I attach no importance to the definition of a chemist which describes him as an organic body more liable than any other of similar nature to spontaneous explosions.)

As I am talking to chemists and not engineers it will be best to begin at the beginning even at the risk of being considered elementary. The popular conception of the engineer is that he is an empiric who has been trained on cotton waste and engine oil. This is, of course, a fallacy. He has just as scientific a foundation for his work as has the organic chemist, and, like him, has a ring structure for the starting point from which spring his great creations. His ring, however, is centuries older and it is basic in simplicity. The diagram (Fig. 1, p. 1186) shows several such rings. Their form is a triangle with rigid sides and a flexible base. If force is applied to the apex the ring is stable and resists distortion under the stress; in other words, it does the work for which it is designed. If force is applied to either of the other two angles it is seen to be unstable and collapses. Two such rings may be joined together with a common base, and the two rings so coupled become a structure which has similar attributes to its components. If force be applied to either or both apexes, this double ring is stable; if to the opposite angles, it is unstable. But if the complete rings are combined to form a compound ring as in fig. 2, the structure becomes a stable one in all directions. The ring formation thus described is the basis of all construction and building in metals, from the framework of the Forth Bridge to that of a Zeppelin.

Let us now consider how the engineer sets out to achieve the task with which he has been entrusted. One of the necessary qualifications of an engineer is the possession of the imaginative faculty; he must see in his mind's eye the general outline of his finished production before it is designed in detail or its creation is begun. What will be his procedure if his work be the construction of, say, the former structure of the two examples just given? Drawings or maps would be useless to him without knowledge of the surrounding landscape itself. He goes then to seek inspiration

on the spot just as a painter would to visualise and make studies for his picture. He watches the long slope of land stretching down to the river's edge from Fife on the one shore and from Linlithgow on the other, and realises that what he builds must join those widely separated crests. He sees before him between mid-stream and the

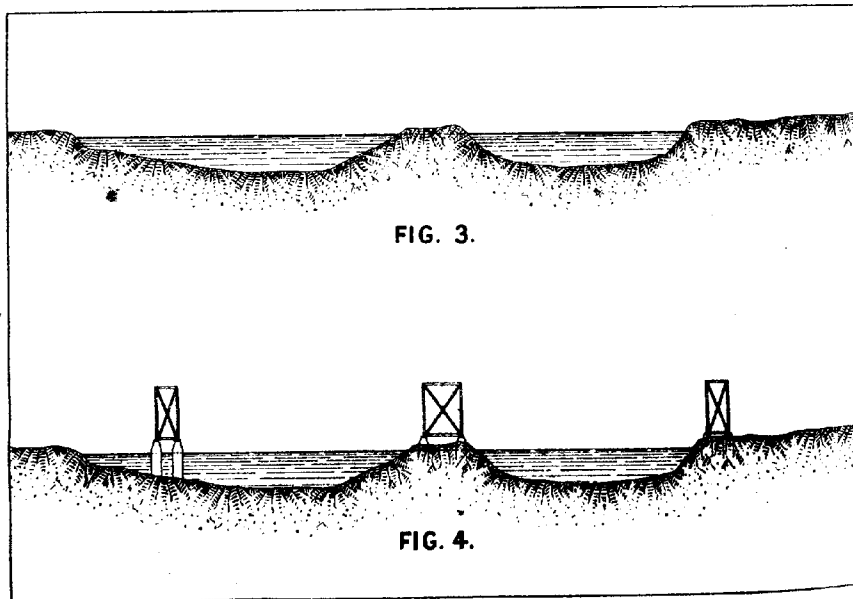


right bank the islet of Inchgarvie lifting its rocky head above the waters of the Forth. Then begin his musings and gradually the mists clear and the mental creation of his work begins. He dreams of setting up on the edge of the river a compound ring structure, placing another on Inchgarvie, and then as the expanse of stream beyond makes the width of span impossible, the idea comes to him of building for himself another islet in steel

and artificial stone corresponding to Inchgarvie and reaching up from the river bed. At these three points he erects his massive compound rings, and from both sides of them he then proceeds to build out other rings each balancing the other and growing smaller and smaller as they stretch to meet each other across the waters below. He joins the gaps with smaller bridges until he makes the whole structure a continuous one from shore to shore. Observe the language of the engineer, Tifan that he is. He has faith in himself, in his ability to master Nature, and he throws a bridge across what she made as a widely-parted chasm. The diagrams show the progress of the work. Figure 3 represents a profile of the spot looking down stream in which Inchgarvie is prominent. The next diagram (Fig. 4) shows the artificial island he plants solidly upon the river's rocky bed on which his compound "rings" stand on feet or bases, and soaring upwards for a height of 350 feet. These "rings" are drawn more in detail in Figure 5, which clearly shows the building up of the structure from simple triangles. The sixth diagram shows the completion of the arms or cantilevers jutting widely out from the big ring, like the arms of some great monster seeking his mate. The seventh diagram gives a more general view of them before joining up, and the eighth figure shows the completed structure itself, more than a mile long and with a clear headway from high water mark of 150 feet, under which our great Dreadnoughts can pass at will.

I want now to invite your consideration of the engineer from another point of view, and which bears a certain resemblance to the immediate necessities of our own industries. The picture on the screen\* is from a drawing made between a half and three-quarters of a century ago. The vessel in the background is a first-class battleship, oak-built and wind propelled. The steamship is the Admiral's tender, and bears a name still honoured in the Service. It is a picture of the beginnings of the mighty Navy which now protects our shores, and which includes battle cruisers

\* This was shown at the meeting.



of such an enormous size that some of them consume fuel at the rate of an equivalent of over one thousand tons of coal per day. Imagine the mechanism of the appliances capable of first producing energy on such a scale down in the bottom of the ship's hold and then of utilising it within her walls! No one could have any doubts as to the important part which must be played by the engineer in such an organisation. Now from the earliest days of the application of steam to the Royal Navy until quite modern times its engineers were looked upon in the same more or less contemptuous fashion as they are not infrequently by chemists to-day. For many a day they messed apart from the ship's officers whose butt for ridicule they often were. In recent years, however, one man great above his fellows set himself to remedy this state of things which threatened seriously to menace the efficiency of the Navy and the safety of our Empire. That man is the present Lord Fisher, and I now want to tell you something of the work which he set himself to accomplish. With, I think, the thoroughness born of the Service to which from boyhood he was attached, he realised the importance of beginning life early, and instead of taking youths, who are more or less spoilt by the kind of training given them at the public schools, the entering age for a Naval cadet was made 13 years or a little more. At that age he is expected to satisfy his examiners in English, History, Geography, Arithmetic, Geometry, French or German, with some knowledge of Latin. From that time his training begins in Physics, Chemistry, Applied Mechanics, Applied Electricity, and, above all, in Engineering with workshop practice. Until he is 17 years of age and goes to sea, that is the training of every officer in His Majesty's Navy. Whether he may be destined for a battleship commander, an engineer commander, or head of a dockyard, the value of engineering in the making of a man as well as training him to a profession is recognised from the commencement. There is, however, a preliminary sorting out which is of great interest and importance. I cannot do better in this respect than quote the words of the Director of Naval Education, in which it is laid

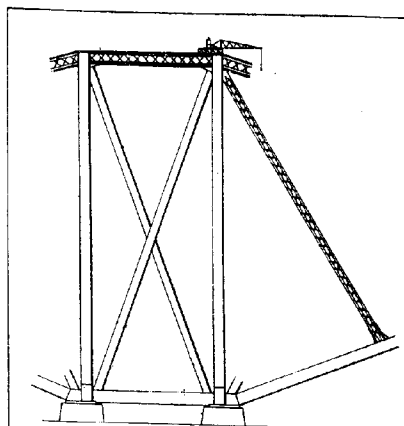


FIG. 5.

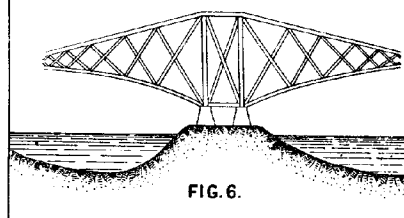


FIG. 6.

down that some indications of the qualities likely to conduce to the boy's becoming a good officer may be discernible by the time the boy is 13. "There is scope and need in the Navy for many types of men and varieties of talent, for the

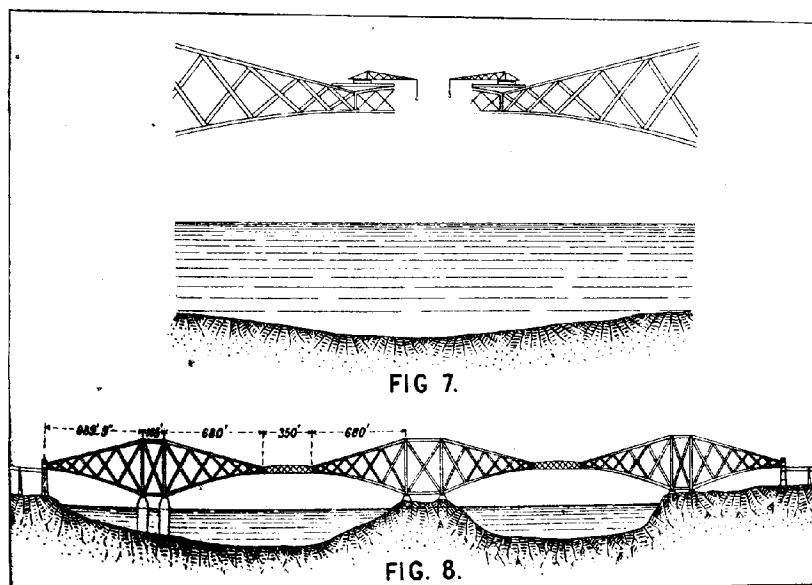


FIG. 7.

FIG. 8.

cultivated faculty of scientific thought and for the personal force that assures leadership. The boy of sensitive, poetic spirit, the ruminating young philosopher, the scholar whose whole heart is in his books, are types that have a real use in the world, but their proper place is not in the Navy. The boy of the right sort will, within the limits natural to his age, show initiative and readiness for responsibility." Such, generally, are the methods by which were trained many of those brave men who are now fighting our sea battles and defending our shores.

Now it seems to me that the condition of affairs in Chemical Industry is very much akin to what has happened in the Navy, viz., that specialised engineering is becoming more and more necessary to it.

I had hoped to have been able to give you on the screen one or two pictures of a modern German-built chemical works, erected on British soil under the regulations of our Patent Laws, but forfeited to the Nation as a result of the war in which we are now engaged. It was considered, however, that this would disclose secrets of design and construction to which the Nation as a whole were not entitled. For my own part I consider that every single detail of the whole of these works should be drawn out and described for the benefit of the entire British Chemical Industry. I look upon this as an absolute right to which the Nation should be entitled. However, I have one or two other slides, very kindly lent to me by Dr. Harker, which will help to point the moral.\*

The first is the power house at Sasheim. Next the Badische furnace at Rjukan. Next the interior of the furnace house in the new factory there. And the last the granite absorption towers. These are, of course, parts of the nitrogen fixation plants. I give them as reminders that engineering design and construction is figuring more and more in modern chemical processes.

Now I believe it is increasingly necessary for the engineer to take a larger part not only in the design but in the running of this special kind of plant. I do not mean that the control should not be chemical, for I think in the majority of cases, if not all, it must be. But I am convinced that when the conditions are found and laid down, the engineer will be quite capable of carrying them out, while his natural ability in handling men and materials cannot but be most useful assets. For instance, it is quite an easy matter to lay down the conditions of working in, say, an autoclave or a centrifugal, and chemical control should be kept over such operations, but the practical working of the machines, their design and upkeep, and the regulation of the attendant labour, the design of the plant and its best lay-out, having regard to the general conditions of economy and the handling of materials, should in a large degree be left to the engineer, since by training he is the more practical person.

If we start with the theory that everybody can be trained to be an engineer or a chemist we shall go hopelessly wrong. The function of our teachers should be to ascertain in what direction the mental capacity of each pupil lies, and to direct him to follow the right main road. It would be very easy to put forward a theory in respect of this if one were needed. In the branch of industry with which I am closely associated, I am aware that in the past there has been much lack of progress through the engineer not deciding to take the chemist into his counsel, but I am also sure of this, that had the chemist been substituted without on his part taking the engineer into his counsel we should have been no further forward. The case is essentially the same for their working in harmony towards the common goal.

\* These slides were exhibited at the meeting.

of perfection. I cannot but think, too, that British chemical industries have been to some extent partly sterilised by the narrow spirit in which some chemical manufacturers have regarded their operations. In my opinion, progress as a whole will be best achieved by them, not by hiding from everybody broad principles of design and working, but by placing reliance upon scientific knowledge and experience to keep themselves in the forefront of their competitors. The general principles of ship construction, of bridge making, and of engine building, to take one or two examples, are open practically to every apprentice engineer, who thus grows up in a general atmosphere of such employment which is of untold value to him if he has ability or opportunity to rise above his fellows and to specialise in any particular direction. And yet there are secrets in ship-building, in bridge-making, and in engine-designing, just as there are in the various chemical industries. The need of such men so trained is now becoming a national one and the full story of their serious shortage cannot yet be told. If we are to maintain our position among the Nations, we must in this respect make a radical change of our pre-war methods. A well-known engineer of wide reputation spoke to me not so very long ago of "those stupid chemists!" and an able Professor of Chemistry said in my hearing, more recently, that "Engineers were such stupid people!" Neither profession deserves such reproaches. The engineer should be taught sufficient chemistry to be able to appreciate the chemist's point of view, and the chemist should know enough of engineering to realise that with the engineer thus trained he can leave the practical application of the processes he devises in the laboratory and supervises in the chemical works.

I have had costly experience of the engineer working in a water-tight compartment of his own, and of the chemist doing likewise. Both courses result in inefficiency. The plan I have found to meet all such difficulties is to organise two distinct staffs under the headship of a chemist on the one hand, and of an engineer on the other, who consult with each other and work together in overcoming the difficulties which daily confront them. I should be sorry to go back to any other system. Chemists and engineers may, I think, be looked upon as the physicians and surgeons of industry, with their respective parts to play in building up and maintaining in increasing strength the well-being of chemical science, and extending its usefulness in the service of man.

#### DISCUSSION.

Mr. J. W. MacDONALD said that he was connected with the business of sugar refining, the success of which had been assured by following out the very principles which the President had advocated. When first he was connected with sugar refining, the managers generally were neither engineers nor chemists, and had a distrust for both the branches of science. But gradually they had learned the benefits of applying both engineering and chemistry, the result of which had been that British refiners, in spite of the bounties, and in spite of the skill of foreign refiners, had held their own, and had in fact even done better than many of their rivals abroad. He heartily endorsed all that the President had said.

Mr. THOMAS TYLER said that the whole question was one of co-operation. That class of manufacturer usually known as the chemical manufacturer, was often thought to be one who did things on such a small scale that engineering and similar problems had not to be considered. The sooner that notion was eliminated the better, for just as great care and consideration for surround

ings and conditions were required on the comparatively small scale as on the gigantic scale. Only by the co-operation and collaboration which had been emphasised by the President, could success be attained. From what he knew of his own competitors in the fine chemical department of applied chemistry, they had all those problems on a smaller scale, but of no less intensity, and there was no less need for the co-operation of the mechanically minded man with the chemical philosopher, student, and technologist. They must put things in their true perspective, and call engineering and other branches of science to their aid, whether the things they dealt with were the big things which had been referred to by the President, or the smaller things.

Professor G. T. MORGAN said that the subject of the need for co-operation of the chemist and the engineer was not a new one in that Section of their Society, because it had been many times advocated in that room, notably some years ago by Dr. W. H. Nichols, who said when he wanted chemical work, he selected young chemists, and when he wanted any engineering problems interpreted, he selected young engineers, and got them to work together. A great deal had been said about their comparative neglect of the chemical industry as contrasted with Germany. His own feeling was that it was simply due to a general lack of appreciation for science. He recalled the fact that such substances as Perkin's Mauve, Meldola's Blue, and Ehrlich's Salvarsan had been started by the chemist *qua* chemist, working from the point of view of the atomic and molecular theories, and then those products had subsequently come within the province of the engineer. He believed the future success of British chemical industry would depend very largely on the personal loyalty subsisting between those who worked at it, whether they were chemists or engineers. It was essential to foster that particular branch of chemistry which was so widely practised in Germany, namely, synthetic chemistry. They had recently been told that that kind of chemist was a molecule juggler. He could not help thinking that the reason France 50 or 60 years ago had not advanced in dye production as much as Germany was because her chemists had failed to recognise Kekulé's important generalisation. Their great chemists were prejudiced, as frequently French chemists are, against the chemistry of other countries, and the consequence was that their young chemists who had to work those dyes out in the factory, were striving in the dark. Unfortunately, the same mistake was being made to-day as then. Chemists were ignoring the teaching of Werner. They had been very troubled in the United Kingdom by a school of what he called Malthusian chemistry, a school which supposed that chemistry could be advanced by restricting the output of new chemical compounds. He believed it was largely the synthetic chemist who would help them to solve the problems they now had to face and who would provide the necessary work for the engineer. The engineer was now being called upon to solve problems arising from the fact that the English chemist was imitating the Germans, but when the war was over it would be found that the Germans had advanced further, and that our synthetic chemists would be called upon to make greater efforts.

Dr. H. G. COLEMAN said that in addition to the question of engineering on the one hand and of chemistry on the other, there was another question to be considered, namely, that of the costs of production. In using the term "chemistry," they were perhaps a little unfair to their "physical" brethren, because chemical industry was equally concerned with physics, and that applied specially on the engineering side. He felt what had done a great deal of harm was, that those who were more specially interested in one of the two sides of

chemical engineering thought that their part was the bigger, whereas all sides, including the human side, were absolutely and equally essential if progress were to be made.

Mr. J. W. HINCHLEY said that he wished to put in a plea for the chemical engineer. It was absurd to talk about the chemist appealing to the engineer unless they defined what sort of engineer was meant. The ordinary mechanical engineer was quite untrained in the particular points which the chemical manufacturer had to handle. The synthetic chemist was necessary, and he agreed with Prof. Morgan that the training of large numbers of synthetical chemists who were mentally and temperamentally equipped for handling synthetic problems was necessary, but the training of chemical engineers was also necessary. In his opinion the chemical engineer had to be a better engineer than a mechanical engineer, as the chemical engineer had to go into the extremes of mechanical engineering and work with materials at the highest stresses possible, subject to corrosion, and under such conditions that the knowledge of the average mechanical engineer was almost useless. They did not want to produce the kind of engineer who simply copied somebody else's machine. The chemical engineer must, in a sense, be a synthetic man, adopting new ideas, working them out, and consequently resisting the average practice of the day.

Mr. BERTRAM BLOUNT said that for some 30 years he had urged the true co-ordination between the engineer and the chemist, and that had been his fortunate experience as a chemist, as he had had the common sense not to pretend to be an engineer, and had collaborated with engineers who did not pretend to be chemists. He had found that collocation entirely satisfactory, as they each knew their limitations. Both sets of people were trained on the sound basis of science to do what they could in the best way, and they could come together and deal with any problem which presented itself to them, on equal terms. Although the blessed word collaboration had been used often enough, he still maintained that that was the best way, and he did not believe in a man being a jack of all trades. He disagreed with what had been said as to the provision *ad hoc* of the chemical engineer.

Colonel SMITHells said that as he had listened to the President, he could not help thinking what a regrettable thing it was that he was one of such a very small number of men in this country who spoke with equal knowledge and sympathy on both sides of that most important question. His conclusion that they must have the engineer trained with chemical sympathies, and the chemist trained with engineering sympathies, was the most important thing in his address, and they must not talk too much about that doubtful and indescribable person, the chemical engineer, being trained for that particular vocation in life. In his experience, extending over 30 years, one of the cries they had had to listen to, and which had been almost louder than any other in the industrial community, had been the cry for chemical engineers. He had been constantly told that was the kind of person they wanted, and ought to produce. He believed that there were different shades of talent and capacity, and, generally speaking, the talent and capacity that made an engineer were not the same as those which made a chemist. Although it sometimes happened that a man was found who was equally susceptible to both kinds of training, those men were the exception and not the rule. Also he did not believe that they would get people who would undergo the long training which would be necessary to make them worth calling chemical engineers, but in all probability they would fall between two stools. Everybody engaged in teaching, and with



speaker's opinion it was the only rational school in this country, and represented the biggest educational experiment which had been made in the world. He had known it intimately from early days, and knew exactly on what lines it was working, and the kind of results they obtained. What they must do in the next few years was to make similar experiments in education in order to find out what was desirable. The question would arise whether special schools should not be developed for the purpose of producing chemists and engineers, and not only naval engineers. The main feature of the school was that it gave only half the time ordinarily given to literary work, the other half of the time being devoted to practical workshop work. The effect was not merely to make the boys efficient as manual workers, but also to make them alert and practical, which was the one thing they needed to do in most of their schools. If to-morrow every school were forced to devote half its time to manual work, they would be taking the most important step forward in education that could possibly be taken. With regard to training chemists and engineers to be one and both, that subject had been talked about as though nothing were known about it. It was forgotten that the Finsbury Technical College, and the City and Guilds College at South Kensington had carried on such work since the early '80's. The Finsbury College had been started by Professors Ayrton and Perry and himself in 1880. They had advisedly insisted that the course of training should be obligatory and should include a certain amount of mathematics, the elements of engineering, especially engineering drawing and some workshop instruction, together with physics and chemistry. That was also carried through at South Kensington. He had spoken on many occasions of the relations between chemistry and engineering. It was not a question of what they wanted to do, but of what they could do. As their President had indicated, the two types of men were not alike. In speaking of them as related as surgeon and physician, he had used a very happy phrase. There was a great deal more behind those words than might appear at first sight. They did not merely indicate two different branches of a profession, but they indicated two different types of mind, the one the man who did the outside carving, and the other man the physician, who sought to look inside and understand some little of what he saw. The chemist was in the same position as the physician more often than not, whereas the engineer was usually in a simpler position. For over 30 years he had tried very hard to give the would-be engineer some instruction in chemistry, but with very few exceptions he had absolutely failed. The man who took engineering because it was in him was a constructive animal, whereas the chemist was much more an analytical animal than a constructive animal. He maintained that what they wanted in the chemist now and for a long time to come was a man who was a chemist and not a mere hanger-on. That was where the Germans had gone ahead so much of late years, and even they had deplored that there had been much less true chemistry taught in their schools recently. In the course of his career he had only known one successful man who had really been congenitally a chemical engineer, namely, Dr. Messel. He had known his works from very early days, and he was one of those astounding men who could be chemist, engineer, financier, and everything else. It was not merely as Professor Smithells had said, that a man could not afford the time to be both. There was no doubt if they could get the men they would be of infinite value, but in framing their scheme of education they had to bear many things in mind, and be more careful in selecting their men and developing them. The man who

would become really valuable as a chemical engineer would be a man who got his experience in works. But they must not forget there were very few works which could afford such luxuries.

Mr. D. A. SUTHERLAND said that the chemical engineer had been recognised in Germany for a long time, and was coming forward rapidly in America. It was essential in his opinion to have a man who had specialised in a particular branch. So many chemists when they went into a works either did not care about, or took no interest in the engineering side of the work. On the other hand he had found that engineers were anxious to grasp the chemical side, but unfortunately they had no knowledge and could not help the chemist.

The CHAIRMAN, in moving a vote of thanks to the President for his address and for allowing them the unusual privilege of discussing it, pointed out that the discussion had not been of a critical nature, for all the speakers had been in agreement with the President, even those who advocated the creation of a chemical engineer, for what they meant was, as Mr. Blount had pointed out, sympathy between the two branches of science which could only be gained by professional experience. A man after he left college might become a chemical engineer or an engineer chemist according to his training and environment.

The PRESIDENT, in reply, said that a great deal had found its own answer in the discussion. He hoped his simile of the discipline of the battleship was an effective answer with regard to the point of dual control. They had on the battleship the engineer who was responsible for the engineering organisation of the ship, but that did not at all affect the fact that it was the captain of the ship who was responsible for the course steered, and for the tactics. No difficulty arose with dual control, nor could he conceive it to be a practical difficulty if it were only clearly understood that both the chemist and the engineer had their limitations. He was very pleased to find how many of those present were convinced that the qualities necessary to make a chemist and to make an engineer were quite different. It was fundamental to the human organisation, and what their teachers would have to do was find a means of discovering it, so that they could, as the speakers had said, lead the chemist along his path, and the engineer along his. There would be some respects in which they would overlap, but he believed the main principle would be, as Professor Armstrong had pointed out, that there were two different qualities of organisation in the brain of the chemist and of the engineer. Nothing would ever alter that; but they must work in the one direction, and their united forces would mean progress.

### Manchester Section.

Meeting held at Grand Hotel on Friday, April 7th, 1916.

MR. J. H. ROSEASON IN THE CHAIR.

### THE MINERAL CONSTITUENTS OF COTTON LINT.

BY J. H. BARNES, B.Sc., F.I.C.

In 1913 a communication was received from a large exporting firm interested in Indian cotton to the effect that complaints had been made by



one of their customers in England that the yarn of certain Indian cottons showed irregularity in its behaviour towards aniline colours. This was attributed by the dyers to the presence of hygroscopic salts in the raw cotton. An examination of this cotton, made on behalf of the exporters, revealed the presence of from 0.073% to 0.014% of magnesium chloride, which might have been added by the producer to prevent the evaporation of the water in the fibre, or might have been a natural constituent of the cotton.

The Punjab Agricultural Department was asked to ascertain the truth of the rumour that mineral salts are artificially added by the Punjabi cotton grower to increase the water holding capacity of the raw cotton.

Arno. Schmidt\* mentions that damping of the cotton to increase the weight of the bales is or was carried on in Berar and the Central Provinces and that saltpetre and seed cotton is used with the same object in the north of the Madras Presidency.

The loose use of chemical terms by such a responsible person is to be much deprecated. Saltpetre referred to as an adulterant of cotton is nearly 1½ times as valuable to the cultivator as the cotton he is selling.

By "saltpetre," Mr. Arno. Schmidt probably means the naturally occurring earth-salts, the composition of which varies but which generally contain sulphates and chlorides of the alkali metals, calcium, and magnesium.

The Punjab Department of Agriculture instructed Mr. Milne, the botanist, to visit the ginning mills of the place specified, viz., Chak Jhumra. He found that the buildings were of mud with mud floors and that these floors showed evidence of earth-salts which are nearly always to be found in such buildings in the cold weather.

The manager of one of these ginning mills gave the information that the farmers do sometimes add earth-salts (local names "shori" or "kallar") with the object of adulterating the raw cotton and increasing the hygroscopic properties, and that factory owners and buyers usually put the samples to the test of *taste* in order to detect this sophistication.

It would thus appear *prima facie* that the complaint lodged by the cotton buyers and users against the producers is a genuine one and that steps ought to be taken to suppress this fraud as one likely to do considerable harm to the whole Indian trade in cotton. Before doing so, however, a further scientific examination of these cottons was deemed advisable and this paper embodies the result of these inquiries. This examination has shown that the inorganic constituents of the cotton fibre are far more variable than has hitherto been supposed, and we are inclined to believe that sufficient importance has not been attached by the grower, the spinner, and the dyer to this point. This paper is to be regarded merely as the prelude to further work on this subject.

The first point to be considered was the average composition of cotton fibre, particularly with regard to its mineral constituents, and to see how far these are likely to influence the process of dyeing.

An examination of the bibliography of this subject shows that it has received the attention of the U.S. Department of Agriculture. In their bulletin No. 33 the following average composition of the American cotton plant and its parts is given:—Roots, 8.8%; stems, 23.15%; leaves, 20.25%; bolls, 14.21%; seed, 23.03%; lint, 10.56%. The mineral constituents in a crop of

cotton yielding 100 lb. of lint per acre expressed in lb. per acre—the weight of the entire crop being 947 lb.—are given as follows:—

Part of plant.		Nitrogen.	Phosphoric acid.	Potash.	Lime.	Magnesia.
	lb.					
Roots	23	0.76	0.43	1.06	0.53	0.34
Stem	219	3.20	1.29	3.09	2.12	0.92
Leaves	192	6.16	2.28	3.46	5.52	1.67
Bolls	135	3.43	1.30	2.44	0.89	0.54
Seed	218	6.82	2.77	2.55	0.53	1.20
Lint	100	0.34	0.10	0.46	0.19	0.08
Total	947	20.71	8.17	13.06	12.60	4.75

No similar figures for East Indian cotton are as yet available; they will be forthcoming in a later contribution. The only information obtainable was with reference to the total amount of inorganic matter present on burning the lint.

The following table gives the amount of ash contained in different varieties of cotton lint according to previous workers:—

	Matthews.	Monie.*
Dharwar .....	4.16	—
Dholerah .....	6.02	4.10
Sea Island .....	1.25	1.10
Peruvian soft .....	1.66	1.50
Peruvian rough .....	1.15	1.25
Bengal .....	3.98	5.50
Broach .....	3.14	2.58
Oomrawuttee .....	2.52	2.93
Egypt brown .....	1.73	1.69
Egypt white .....	1.19	1.75
Pernambuco .....	1.60	1.98
American .....	1.52	(Texas 2.1 Orleans 1.6)

\* For commercial cottons as they arrive at Liverpool.

In this table Matthews infers that Monie does not include the amount of mineral matter in the fibre of the cotton but only the sand or foreign mineral matter held mechanically in the baled material. I do not think this interpretation is correct, however. It seems based on this author's opinion that the amount of ash in true cotton fibre never exceeds 1% (J. M. Matthews, "The Textile Fibre," J. Wiley and Sons, 1907, page 211).

I shall show later that this is not true for Indian cottons.

The ash of true cotton fibre consists of the carbonates, phosphates, chlorides, and sulphates of potassium, calcium, and magnesium. Some difference of opinion seems to exist as to the amount of these constituents, as may be seen from the following table quoted from Matthews' "Textile Fibres," page 212.

Mineral constituents of true cotton fibre.

	Ure.	Davis, Dreyfuss, and Holland.*
	%	%
Potassium carbonate .....	44.8	33.22
Potassium chloride .....	9.9	10.21
Potassium sulphate .....	9.3	13.02
Sodium carbonate .....	—	3.35
Calcium phosphate .....	9.0	—
Calcium carbonate .....	10.6	20.26
Magnesium phosphate .....	8.4	8.73
Magnesium carbonate .....	—	7.61
Ferric oxide .....	3.0	3.40
Aluminium oxide and loss ...	5.0	—

\* Mean % 12 different varieties.

\* International Federation of Master Cotton Spinners and Manufacturers' Association, Secretary's reports, Dec., 1911,—Jan., 1912, page 82.

These figures may be compared with analyses made in the Lyallpur laboratory of a number of cottons from different sources.

support in the amount of silica and chlorine found to be present. Secondly there is no apparent connection between the moisture contents of the

*Analysis of East Indian cotton lints, Lyallpur 1915 (Barnes).*

Register No.	Description of sample.	Moisture, %	Ash, % on dried lint.	Ash analysis, %.		
				Soluble in HCl.	Silica and silicates insol. in boiling HCl.	Chlorine.
37	Lint fully good med. Texas	5.41	1.27	86.98	13.02	2.81
38	Lint fully good med. Memphis 13/16 in. staple	5.36	1.92	89.29	10.71	4.88
39	Lint fully good med. Arkansas 15/16 in. staple	5.09	1.67	93.68	6.92	2.23
40	Lint fully good med. 13/16-1 staple Arkansas	2.34	1.33	83.87	16.13	4.35
42	Lint American Sea Island	2.32	1.18	84.29	15.71	4.23
43	Lint Brown Egyptian	2.46	1.50	85.56	14.44	4.34
44	Lint White Egyptian	2.23	1.37	88.05	11.95	4.11
45	Lint Alov.	2.59	2.37	85.60	14.40	5.11
41	Lint Amble (Guzerat)	2.23	3.99	84.44	15.56	6.55
46	Khandwa	5.45	1.86	84.77	15.23	2.92
47	Lint Kirtilly	5.01	2.76	81.15	18.85	2.98
48	Lint Nanded (Barsa)	4.74	3.08	72.00	28.00	2.62
49	Lint Parbhur (Barsa)	4.89	3.71	68.28	31.72	2.99
50	Lint Sawbul	4.48	3.06	83.1	16.9	3.75
51	Lint Fine Branch	4.28	2.24	91.33	8.67	4.39
52	Lint Sample No. 1	4.68	1.63	94.47	5.53	4.42
53	Lint Sample No. 2	3.78	1.85	85.6	14.4	3.84
54	Lint Sample No. 3	3.79	1.96	95.58	4.44	2.48
55	Lint Sample No. 4	3.30	1.34	93.85	6.15	4.89

Samples Nos. 37 to 44 exclusive of No. 41 were supplied by the British Cotton Association; they are ordinary market cottons, not East Indian. Nos. 45 to 51 and No. 41 are genuine specimens of cotton grown in the Bombay Presidency and were supplied by the Imperial Cotton Specialist. Nos. 52 to 55 are Punjab cottons picked near Chiniot Road under the supervision of the Economic Botanist. A copy of Mr. Milne's note regarding these samples is given in the footnote.\*

These latter samples may be taken as representative Punjab cotton such as was grown in the Lyallpur district in 1913-14. One of these samples (No. 3) was picked from plants growing on saline soil. Saline patches exist throughout the Punjab cotton tracts and the land around Chiniot Road is no exception but is rather worse in this respect than much of the surrounding country.

The principal points brought out in this table are these:—

In the first place Matthews' contention that the ash of genuine cotton lint does not exceed 1% is not borne out by the figures obtained at Lyallpur; either for American or for Egyptian cotton samples supplied by the British Cotton Association or for pure East Indian lints, and the wide variation in the amount of mineral matter found in different varieties of genuine cotton lint precludes us from laying down any specific figure for this as a determinant factor of purity. This received

lint and the amount of mineral substances present in the ash of the cotton. This latter seems to indicate that these mineral substances have been taken up by the plant itself in the course of its growth and are contained in the substance of the fibre. They are evidently not on the outside of the fibre, otherwise they would render the mixture attractive to water. Thirdly, there is the widely divergent figure for silica and silicates (mineral matter of the ash insoluble in boiling hydrochloric acid); with the sole exception of samples 53 and 53, the local Punjab cottons contain less than any of the Bombay cottons and do not differ very much from the American, Egyptian, or Island cottons supplied by the British Cotton Growing Association. Sample No. 53 is higher than No. 52, though why I cannot say. It is supposed to be the same as No. 52 with the exception that it was stored under better conditions, namely, on a brick floor instead of on one of beaten earth. There was no evidence of salt on the bricks and the moisture contents of No. 53 preclude any supposition that it had been watered and had drawn its salt from the soil, for the total amount of ash is very little higher, while the silica and silicates are much higher. No. 53 is much cleaner than No. 52 so we cannot explain the difference as due to dust or dirt.

I am inclined to lay stress on the composition of the ash and particularly on the insoluble portion of this as likely to be of importance to the dyer and spinner in affecting the behaviour of the cotton towards the chemicals used in dyeing. The presence of minerals in such a varying proportion cannot be without effect on the physical properties of the fibre, that is on the strength and life of the yarn. Within the limited scope of the inquiry there seems to be some connection between the quality of the fibre and the amount of silicates present in its ash.

Unfortunately I have not had the opportunity of pursuing the inquiry to the point of examining in detail the chemical composition of the ash of all these samples or of going further afield in the analysis of other cottons of known origin and value, though I am sure such an inquiry will yield results of great practical importance to both the grower and the user of the cotton.

The following table gives the complete analyses of two of the above samples.

\* Description of samples collected by Mr. Milne:— Register No. 52. (Unginned desi cotton.) Taken from the cotton store-room at the extreme south-west side of the Haji Amanullah Fasal Din Factory. Walls of room of mud, floor of unbaked brick, no sign of "kallar." The cotton was taken from very near the floor and it had been there for 12 days or so.

Register No. 53. (Ginned desi cotton.) Taken from same factory as sample No. 1 and from the store-room of unbaked and which that sample was taken. Walls of room of unbaked and floor of burnt bricks laid in mud. Sample taken from near the floor and had been there for 5 days approx. The room seemed free from "kallar."

Register No. 54. (Unginned.) It is a mixture of local Indian and American cotton. The sample was taken in my presence from fields of these mixed cottons badly infested with "kallar." The fields belonged to Lal Singh Bhagwan Singh of chak 185 R.B. The crop was very poor, owing, it was said, to "kallar."

Register No. 55. (Unginned Indian cotton.) Picked by myself and others from a field close to Chak Jhumra railway station and to the north-west of it. The field belongs to chak 186 R.B. village Dogranwala. The crop was healthy and there was no sign of "kallar" in the soil.

Composition of the ash of pure cotton fibre.  
Lyallpur 1915. (Barnes.)

Ingredients.	Sample No. 41. (Amble Guzerat, Bombay.)	Sample No. 53. (Chinlot Road, Punjab.)
Silica (insol. in hot HCl)...	15.56	14.40
Alumina .....	10.80	12.87
Iron oxide .....	5.89	1.92
Lime .....	9.75	10.65
Magnesia .....	1.87	4.36
Sulphates (as SO <sub>3</sub> ) .....	1.96	2.52
Phosphorus pentoxide .....	3.25	4.45
Potash .....	27.32	26.03
Chlorine .....	6.55	3.84
Carbon dioxide .....	12.19	8.03
Soda .....	4.51	8.40
Undetermined and loss .....	0.34	2.52

This table shows a great difference in the composition of the two samples. Perhaps one of the most interesting features of this difference is the greater percentage of ash of No. 41 together with its higher carbon dioxide content as compared with the sample No. 53; the presence of a large proportion of carbonates in the ash seems to indicate that the metals in this sample were (previous to its ignition) present as organic salts to a greater extent than were the metals in sample No. 53. This would account for the production of more carbonates on ashing.

How far this results from the chemical nature of the soil, the type of plant, and the conditions of growth, the water supplied, and the temperature and humidity of the atmosphere, we do not know, but it offers a fruitful line of inquiry. So also does the relation between the composition of the fibre and its value to the manufacturer. Sample No. 53 was grown on soil and under climatic conditions which, we believe, should result in a maximum absorption of saline matter. The soil is saline to the point of barrenness in places—the climate is such as to induce the maximum amount of transpiration of water from the leaf, for the Lyallpur district lies in one of the hottest and driest portions of N.W. India, the whole of the cultivation there being carried on by means of irrigation canals. On the other hand the cottons from Bombay are with one exception far more heavily impregnated with saline matter, in spite of the damper and more equable climate there during the growing season, which must certainly result in lower losses of water by transpiration.

In the Punjab, cotton sowing takes place in the end of March and the harvesting commences at the end of October and goes on until the middle of January—an average of from 8 to 8½ months for the crop. In the Bombay Presidency (Kirkree) sowing takes place in June (about the 10th), and harvesting is complete by January 15th. The crop in this case occupies the ground for about 2 months less than it does in N.W. India. It seems strange, therefore, that the cottons of this tract should contain more mineral constituents than do the cottons of N.W. India, which have a longer growing period and which, as we have shown above, are moreover grown under conditions which induce a presumably higher rate of transpiration. It is clear that the subject requires further investigation.

Church and Müller (Matthews' "Textile Fibres," page 213) gives the composition of raw cotton as follows:—

	I.	II.
Cellulose .....	91.15	91.35
Hygroscopic water .....	7.56	7.40
Wax and fat .....	0.51	0.40
Protoplasmic nitrogen .....	0.67	0.50
Cuticular tissue .....	—	0.75
Ash .....	0.11	0.12

Bull. 33, U.S. Department of Agriculture gives the proximate constituents of cotton to be:—Water, 6.74%; ash, 1.65%; protein, 1.5%; fibre (cellulose), 83.71%; nitrogen-free extract, 5.79%; fat, 0.61%. I am inclined to consider these latter figures to be the more representative; they are supported by the results of my own investigations so far as these are comparable.

It is of course known that all cellulose fibres, no matter from what source they may be derived, contain inorganic salts. It is known also that all these salts have been derived from the soil. It does not seem a satisfactory explanation to consider the salts found in cellulose fibres as the residue left after the drying up of the plant sap, for we know that such fibres resist the extraction of the mineral constituents to a remarkable degree. The amount of ash for example in bleached cotton varies from 0.1 to 0.6%, while special filter paper prepared for laboratory use by successive treatments with hydrochloric and hydrofluoric acids still often contains as much as from 0.03 to 0.05% of ash. What is more important is that so far as is at present known, it is impossible to remove the last traces of such mineral matter by chemical treatment.

Ladenburg (Ber., 5, 568) and Louge (Ber., 11, 822) as a result of an investigation of the ash of certain *Equisetum* species, consider that there is no evidence of an organic silicon compound in the plant. Likewise the rigidity of the bamboo and of the cuticular tissues of the cereal straws does not appear to be due to siliceous compounds. On the other hand the ash of a fibrous structure takes the form of the organic original, thus showing the mineral constituents to have existed throughout the fibre.

The presence of large and varying amounts of carbonates in the ash of cotton fibre leads us to suppose that some portion of the mineral matter is present in combination with an organic acid. Pectin salts play an important part in forming the binding substances between plant fibres. They have been shown by Mangin to consist of two classes of substances, viz., (a) neutral bodies including pectose, which is an insoluble compound closely resembling cellulose in its properties, and bodies of a gelatinous nature soluble, in water, known as pectins, (b) faintly acid substances, the principal member of the group being pectic acid which occurs in nature as calcium pectate. Such acids will account for the absorption of some of the mineral matter, and indeed neutralisation of excessive acidity may be one of the functions of alkaline salts in the sap of plants. Variation in the amount of the acid will lead to variation in the quantity of carbonates produced on ashing the fibre. The acid portion of the pectin group, the pectic acid, will therefore probably play an important part in the absorption of mineral matter by the fibre.

But besides this we know that cellulose has a high absorbent action on mineral salts in solution. This is admirably illustrated in the well-known experiment with barium hydroxide and phenolphthalein solutions on filter paper.

When solutions of these substances are allowed to wet a piece of filter-paper by placing a few drops of each some distance apart, so that the expanding wet portions gradually overlap, a pink colour is not developed immediately on contact of the phenolphthalein ring with the barium hydroxide ring—this follows later. As the solution of the alkali proceeds to spread through the paper the concentration of hydroxyl ions diminishes at the outer edge due to adsorption by the fibre of the paper. This affinity of the fibre for the salt is due to the presence of colloidal bodies possessing this special property. The same phenomenon is observed in some soils containing clay in a colloidal form. Pectins on the one hand, as well as pectoses and

cellulose on the other, probably possess this property in a variable degree. The affinity of cotton for certain dyes is closely connected with this property. See Biltz (Nachr. Wiss. Göttingen, 1904, 1) and Suida (Sitzungsber. Wien, July, 1904), Knecht, Rawson, and Loewenthal ("Manual of Dyeing," C. Griffin, 1910, Vol. I, pages 19, 25, 32, 38, 73, 78, 79, 87 and 89).

Matthews ("Textile Fibres," page 211) states that pectin compounds form the greater part of the impurities present in cotton. Suringor and Tollens (Z. angew. Chem., 1897, 1), examining the statement made by Link and Voswinkel (Pharm. Centralhalle, 1893, 253) that raw cotton yields wood gum as a product of hydrolysis, were unable to obtain any pentoses as products of acid hydrolysis of raw cotton and traces only of carbohydrates yielding furfural; they infer, therefore, that raw cotton contains no appreciable quantity of pentosans.

The widely different opinions of these several workers indicates the need of further investigation on the composition of different varieties of cotton grown in India.

According to Schunck (Matthews, page 210) American cotton contains about 0.84% of fatty matter while East Indian cotton contains only 0.337%. This oily matter appears to be identical with cotton seed oil.

The following table gives the results obtained at Lyallpur for the amount of ether extract obtained from the samples mentioned above.

Sample No.	Ether extracts from East Indian and other cottons.
	%
37	0.496
38	0.560
39	0.618
40	0.630
42	0.316
43	0.384
44	0.216
41	0.308
45	0.232
46	0.412
47	0.280
48	0.236
49	0.576
50	0.452
51	0.188
52	0.272
53	0.260
54	0.228
55	0.214

We do not obtain such high figures for fatty matter from either the American or East Indian cottons here examined as do other authors. Though low in its fatty contents the cotton of the Lyallpur district still contains sufficient of these substances to render it resistant to wetting by water.

The subject of the wetting of cotton by water and water vapour has been examined by Masson (Proc. Roy. Soc., 1904, 74, 230). His results, however, have not led to elucidation of the actual mechanism of interaction of the fibre and water. Further information on the subject seems required.

#### Summarising :—

There appears to be no evidence of the reported practices of salting the cotton to increase its water-holding capacity. Arno. Schmitt reports that he has seen watering of raw cotton actually taking place, but this is a crude form of sophistication and will certainly lead to deterioration of the fibre and cannot but come to the notice of the buying agents of exporting firms in India. It will thus rebound immediately on the persons practising this fraud and can be dismissed from the scope of this inquiry.

The complaint that the Chiniot cotton contains an unusually high percentage of magnesium chloride seems to be true, but we do not think that this substance has been artificially added, for the analysis of sample No. 53 shows that it compares with other genuine samples in the amount of water and mineral matter which it contains. The assumption that cottons grown on saline soils will produce a fibre more heavily impregnated with mineral matter does not seem to be justified by the results, for alkaline soils are much more prevalent in the Punjab than in Bombay.

The total amount of ash material in cotton fibre seems to have been under-estimated by previous workers, who seem to have assumed that this was largely due to foreign mineral matter in the form of dirt in the baled cotton.

The presence of highly varying quantities of silica especially seems to have escaped attention. I am inclined to lay considerable stress on the established fact that genuine cotton fibre may contain upwards of 1% of ash and that the composition of this ash is variable, and variable to a far greater extent than has hitherto been supposed.

There is little doubt but that this will seriously affect the reaction of the fibre to dyes; how far it will affect the tensile strength and keeping qualities of the fibre remains to be shown. It is evidently a factor which both grower and breeder must take into consideration, namely, the nature and quantity of the mineral salts taken up by different varieties of cotton grown in the same soil and under the same conditions and how far climatic variation will affect this as well as the effect of these mineral constituents on the commercial value of the fibre.

### Nottingham Section.

Meeting held at University College, Nottingham, on Wednesday, October 25th, 1916.

DR. R. M. CAVEN IN THE CHAIR.

### THE CHEMICAL EDUCATION QUESTION. (Abstract.)

BY R. M. CAVEN, D.Sc., F.I.C.

Since the occasion of my address to this Section on "The Education of the Industrial Chemist of the Future" (this Journal, 1915, 533), so much stress has been laid upon our national needs by those in high authority that it may well be supposed the public has been really awakened to these needs, and will consequently be asking advice as to how to meet and supply them.

It is true that our existence as a nation does not depend immediately on our general scientific equipment as it has depended on our equipment in munitions; but there are many who think that our existence in the future does so depend. Therefore if we are really aware as a nation of the scientific needs of the future, we ought to consider earnestly how they are to be met.

No doubt he would be a bold man who would advocate immediate expenditure in building new schools of science, or enlarging old ones, but it is the plain duty of those who can read the signs of the times to point to the inevitable need for such new or enlarged schools in the future, and for the adequate provision of qualified teachers to work within them.

It appears to me that the fundamental problem that confronts us as a nation and empire at the

present time is this: How to cause the scientific spirit to permeate all our national and imperial enterprises. The problem is vast indeed, and the first necessary step towards its solution is the recognition amongst all classes of society of the Universality of Science. If we narrow the issue to chemical science alone, the question becomes this: how is our science to be made to permeate all those industries in which chemistry plays a part? And in truth this question is but a little narrower than the general scientific question; for it would be hard to find an industry in which chemistry plays no part.

In the teaching of evening students engaged during the daytime in industrial operations and anxious to acquire some knowledge of the chemistry of their industry, a matter of some difficulty arises. What is to be done for a student in a specific trade, who without any previous chemical knowledge wishes to learn quite quickly the chemistry of his trade? Here for example is a student who wants to learn the chemistry of leather-dressing. First, we enunciate the principle that some general knowledge of chemistry is necessary, before the science can be applied to any trade. The student acquiesces, and the elementary work begins. One of two things will then happen: either the student finds that he has no bent for chemistry, and promptly disappears; or else he persists, and in time grows restless and wants to come to leather-dressing.

In this case some conversation on the subject gives one points on which to hang a system of practical work; and perhaps a little book may be found which gives some really serviceable advice. The student finishes his course; he has done the chemistry of leather-dressing—or what not—and returns to the factory to apply his knowledge. What does not transpire—what we never know—is just precisely how far the industry of leather-dressing is advanced by this student's special course. Does any good come of it? In view of the high ideal of chemical training we are striving after, and of the extraordinary complexity from a chemical standpoint of many trade processes, can any good come of such partial training, such tinkering at the subject? Really I do not know. This is an illustration of a problem of chemical education that we need to solve.

Regarding the question of the education of the chemist in the highest sense, I would point out that this education and training do not begin within the walls of the university or college. There is the previous school course to be thought of. The complaint has been made that not enough science has been taught in our schools. That is no doubt true of some of our great public schools, but it is not universally true. Instead of complaining of the lack of science, I would rather complain of the lack of the scientific spirit, laying emphasis on the words of the Poet Laureate: "Not only should natural science be introduced, but all teaching of all subjects should be scientific in method." That is what matters most. If I have any criticism to offer of the school training of some of our chemical students, it is that they have been taught too much chemistry of a sort, not too little.

In my opinion qualitative analysis in the ordinary sense should not be taught at school. It should be reserved until the student is gaining a thorough insight into the chemistry of the principal elements, and of the nature of solutions; until his mental outlook is sufficiently advanced to enable him to appreciate the significance and beauty of the chemical separations which he carries out. Volumetric analysis should precede qualitative work, but here, again, the accuracy aimed at is more important than the number of methods studied. Nothing can be more harmful than for a student to rush through a number of volumetric

methods in order to comply with an examination syllabus, and very likely to pass the examination, because no very high standard of accuracy is required in the examination room; for the habit of slipshod work is most difficult to eradicate, and should never be contracted to meet the exigencies of any examination.

I would suggest that if a boy matriculates at sixteen, and has another year at school, it is better that he should not immediately prepare for the intermediate science examination, but should occupy his later schooldays, before entering college, with the quiet maturing of his knowledge and his faculties. And if I am asked how he should occupy his time during this year, I suggest that the year should be a wander-year, a year of intellectual and spiritual preparation for the life of the university.

What an advantage it would be to a boy if before entering college he could learn a little about the historic sources of his science, and sit for a time at the feet of the great masters of the past. Then careful quantitative experiments should be devised and carried out with the greatest possible accuracy. At the same time numerous exercises in practical physics and physical manipulation might be worked, the main purpose throughout being that rigorous training in accuracy and delicacy of thought and action without which no true science is possible. Some slight acquaintance with biology, economic geography, and geology might also be gained during the year.

The college course of the chemical student is clearly indicated, and consists of the simultaneous preparation for an honours degree in chemistry and for the examinations of the Institute of Chemistry. I see no reason to complain of such a course, and I do not know how it could be improved upon. I sometimes think, however, that it is an anomaly that the same degree syllabus should be made to serve, whether the student is to become a teacher, an analyst, or a works chemist, but as regards the syllabus of the Institute of Chemistry, it seems to me altogether admirable, and indeed stiff enough to deter all but the most brainy and enthusiastic people from daring to embark upon the career of a scientific chemist.

While it is undeniable that facts may be learnt from books, there is no such thing as action at a distance in a true chemical education, any more than in a true chemical reaction. Continuous intercourse must be maintained between teacher and student, and one cannot exaggerate the importance of the personality and scientific ideals of the teacher.

In my former paper I discussed the question of the technical training of the chemical student, and whether he should receive instruction in actual technical processes during his college course. The question appeared to be one of difficulty, but Mr. F. H. Carr has recently (this J., 1916, 949) offered a valuable solution of this particular problem.

#### DISCUSSION.

Mr. H. DROOP RICHMOND said that there should be more co-ordination of chemistry and the allied sciences in teaching. In the universities a little more might be done in the way of teaching chemistry from the point of view of mass and energy and value. There should also be more co-ordination between the mathematical side and the chemical side, and the student should not only be taught the language of chemistry and the language of mathematics but be taught to translate the one into the other.

Mr. S. G. SASTRY said that a small works could not always afford to employ a qualified chemist and in consequence was driven to the public analyst. The interests of the proprietor of such works should be safeguarded and his secrets not

divulged. If each society could have a central laboratory which would undertake all important investigations for the advancement of chemical industry, perhaps manufacturers might be induced to confide in those engaged in such a laboratory and thereby improve their own industries.

Mr. C. H. PARSONS said that a little knowledge would enable those who had simple processes to conduct to follow more clearly the instructions of their superiors. Therefore he would suggest that those who had not the scientific spirit but yet had the desire and the ambition, should be allowed to know something about the processes they worked. It was a good thing that they should have even a small smattering of knowledge. Many years ago he (the speaker), as junior chemist in a works, with only a smattering of chemical knowledge, had been able to arrest a process that was an absolute failure and transform it into one that was profitable. Small works could co-operate by either employing or supporting a trained man in their special trade. Managers of works should be educated to the necessity of the trained man. A man could not do good work on £2 a week or anything like that.

Professor F. S. KIPPING said that on the question of how chemists should be trained, after the B.Sc. had been passed, there were two utterly divergent opinions. One opinion had been expressed by Mr. Carr, who thought that the chemist who was going into a works should go to a college where he should learn a great deal of engineering, a great deal of chemistry, and a great deal of what might be called the commercial aspect of the case. The other point of view, and one which he himself held, was that the career of the student was so short that it was impossible to give him training of that kind, if he were going to be a scientific chemist. Now the chemists engaged in works have to carry on totally different duties; therefore it seemed to him that their training should be absolutely distinct. The question arose where and how was that training to take place? In a college like University College, Nottingham, any attempt to teach the commercial aspects of chemistry necessary for a departmental manager would be a failure: in the college suggested by Mr. Carr no doubt it might be a very great success; but for the great majority of students it seemed to him that it would be sufficient to train them in research. Would it not be possible for the training of the chemist as regards his research work to take place in the recognised colleges, and for his further training to take place in the works? It would seem that such an arrangement should fulfil all the necessities of the case. Works managers, he understood, were now willing to take chemists who had no training as works chemists. Many works managers in fact, did not wish to have any technical bias given to the training of their chemists while at college; they wanted them to be trained merely in pure science; then when the chemists went into the works laboratory they could be sorted according to their ability and employed either as practical men or as research chemists. It seemed to him that the training of departmental managers should be done in the works. In colleges or universities any attempt to give a distinctly commercial bias to teaching would be worse than useless. What they had to do was to train in methods of research—to train not only chemists but men who would be reliable and useful in many other directions as a result of such training.

Mr. F. H. CARR agreed with practically all Dr. Caven had said. So far as his experience went of candidates for positions, and he had met a great many such, it had always been that the man who had thought himself to be most excellent was he who had done best at examinations, but in most cases

that was the very man who was least likely to fill the vacant post well. And it was not at all uncommon to come across a candidate who imagined that one should make no enquiries beyond asking whether he had passed this or that examination. Now that attitude of mind was unmistakable evidence that the man would be a failure in the works.

As regards the man who attended evening classes and got just a smattering of knowledge, he agreed that if a student were properly taught and if he really did learn ever so little, he became a better employee for it; it was not that he had become a chemist or anything of the sort, but he had got something to which his works experience could add more. He was extremely interested in the suggestion of a "wander-year." The idea was quite new to him, but it coincided in some ways with the proposal to teach in the sixth form of our schools something of the achievements of science and of the work of great men of science, and that was perhaps even more suitable for those students who had not taken science than for those who had. It had never occurred to him, however, to go to the extent of making it a whole year's course preparatory to science.

In answer to the point raised by Prof. Kipping respecting the utilisation of the study of research as an introduction to the technology of chemistry, in the paper referred to he had carefully pointed out the difficulties of that. It was a fundamental mistake that had been made in this country. Research men were wanted in works, but still greater than that need was that of chemists with certain qualities of mind and of interest which were different from, though not incompatible with, those of the research chemist. That was the gist of the argument on which he based his distinction between the training of a research chemist and a commercial chemist. His suggestions related to a post-graduate course and not to the training inside a university. As to whether there was possibly time for such a scheme of education in the student's career, a chemist did not complete his training in three years whether he became a research chemist or an analytical chemist, nor could the works chemist complete his training in that time—it took at least five or six years and then he had not finished.

Mr. T. H. GRAY said that the great thing to consider was whether a man was to be a research chemist, a works chemist, or a departmental manager—whether a man should be trained on highly scientific lines or in a haphazard way was not to the point.

Mr. M. BARROWCLIFF said that in the college the inculcation of the "spirit of research" should not be left for a post-graduate course, which so few were able to take. The thorough working out of the preparation of quite simple and well-known organic substances to the extent of finding the best method and obtaining the highest yield called for the same qualities as did a complicated new synthesis. They would get better men, in his opinion, if each student in his third year, instead of carrying out indifferently a large number of preparations, were given one only at a time and required to work it out completely over a number of weeks or months, with the collaboration of the demonstrator. The training and experience gained in a laboratory where a number of those simple researches were being simultaneously carried out would be of much greater value than under present conditions.

Dr. E. B. R. PRIDEAUX said that of the obstacles which stood in the way of Great Britain being in the future the most important centre for the industrial utilisation of the raw materials of the Empire, not the least was the lack of men trained to use their heads as well as their hands. In

many industries the day of the factory "hand" was rapidly passing away, and the less progressive nation which allowed an unduly large proportion of industrial work to be carried out by unskilled labour, would inevitably be beaten both in peace and war by others which had the skill and foresight to make the greatest and most economical use of natural sources of energy. Therefore a preliminary training of at least one year in mathematics, physics, and chemistry must in the future be placed within the reach of a large majority of the population. The instruction should be given in continuation schools, either day or evening, which should continue the elementary education system without a break. It will be quite impossible for existing technical schools to deal with the numbers; and the multiplication of technical schools for this purpose seems unnecessary. A technical school of a good type was equipped for other work than the giving of the irreducible minimum of instruction to the rank and file of the industrial army.

Beyond that, educational facilities ought to be such that every man should be able to progress just as far as his abilities and energies permitted. That was the field of the technical college and the university which might, broadly speaking, train the works manager on the one hand, and the researcher or inventor on the other. The continued education of the vigorous thinker who was to take a leading position in industry was a matter which has been discussed recently in this Society, and a most valuable definite scheme had been put forward by Mr. Carr. In discussing such schemes there were two points which must always be borne in mind. In the first place it was most desirable that the university should develop freely the individual bias of the student if any such were displayed in the post-graduate years. In the second place, there were often most stringent limitations to what the university or college could attempt, on account of lack of room, lack of funds for supplies, and a staff far too limited both in numbers and in opportunities. Those conditions would probably get worse unless the large industrial concerns came to the rescue. Even with all those disabilities, a closer association between the university teacher and the technical specialist, who was or ought to be still a student, offered some advantages to each. In the first place the professional teacher could often teach, that is to say he was accustomed to explain all kinds of chemical operations and theories for hours at a time. The specialist often arrived at his ideas by a very rapid train of reasoning, and had some difficulty in explaining them to immature or uninstructed minds. A teacher might even put the original ideas of a specialist so clearly into words, that other ideas might be suggested. Then again, a teacher possessed a fairly wide knowledge of principles, and hence had a certain power of outlining new situations and getting new points of view, which was sometimes lacking when the mind had been concentrated too closely on a particular department, and mainly with an eye to costs and yields. That was the justification for university courses on general or special departments of chemistry which had been studied by the teacher mainly from the theoretical point of view.

If the technical specialist would more often in return invite the teacher to see some interesting process, and let him see how and where the economic factors come in, the benefit would be mutual.

The CHAIRMAN, in reply, said he believed it was a common practice in Germany for a young man of means to have a year of travel before he settled down to his life work, and if it were desirable for a young man to have such an experience at the

end of his university course, it might also be well for a youth to have an analogous intellectual experience at the end of his school life, and before he went to the university.

## Communication.

### THE STEM CORRECTION OF THERMOMETERS.

BY EDWARD G. WHEELER, A.I.C.

During continuous distillation in the laboratory, the conditions for the accurate demonstration of the temperature of vapours leaving the distillation flask or rectifying head, preclude the total immersion of the mercurial column of the thermometer in the vapour of a boiling liquid.

A correction, therefore, becomes necessary for the heated portion of the thread. It may happen that circumstances require this to be ascertained speedily, for a succession of readings, during, for example, the separation of a series of fractions by a continuous distillation, when there is hardly time to make the necessary calculation.

The correction has been expressed by the formula  $C = K(t - t_1)n = K(t - t_1)(t - t_{11})$ , where  $t$  = the observed temperature on the thermometer;  $t_1$  = the temperature of the external column, as determined by an attached thermometer;  $t_{11}$  = the first unexposed graduation on the thermometer;  $n = (t - t_{11})$  = the length of the external column expressed in degrees, and  $K$  = a coefficient representing a function of the length of the external column,  $= (\alpha + \beta n)$ , but which according to Thorpe (J.C.S., 37, 159) can be taken as having a mean value of 0.000143, and which gives sufficiently accurate results for all values which are likely to occur in practice.

Although the component parts of the correction  $C$ , are independent of one another, it has been found possible by means of the accompanying graph, to read off the stem correction directly, from the observations made, viz., from  $t$ ,  $t_1$ , and  $t_{11}$ . The method of utilising it is as follows:—

Find the junction of the ordinate of  $t_1$  and the abscissa of  $t_{11}$ , then move parallel to the curved lines to the junction with the ordinate of  $t$ , when the corresponding stem correction can be read off.

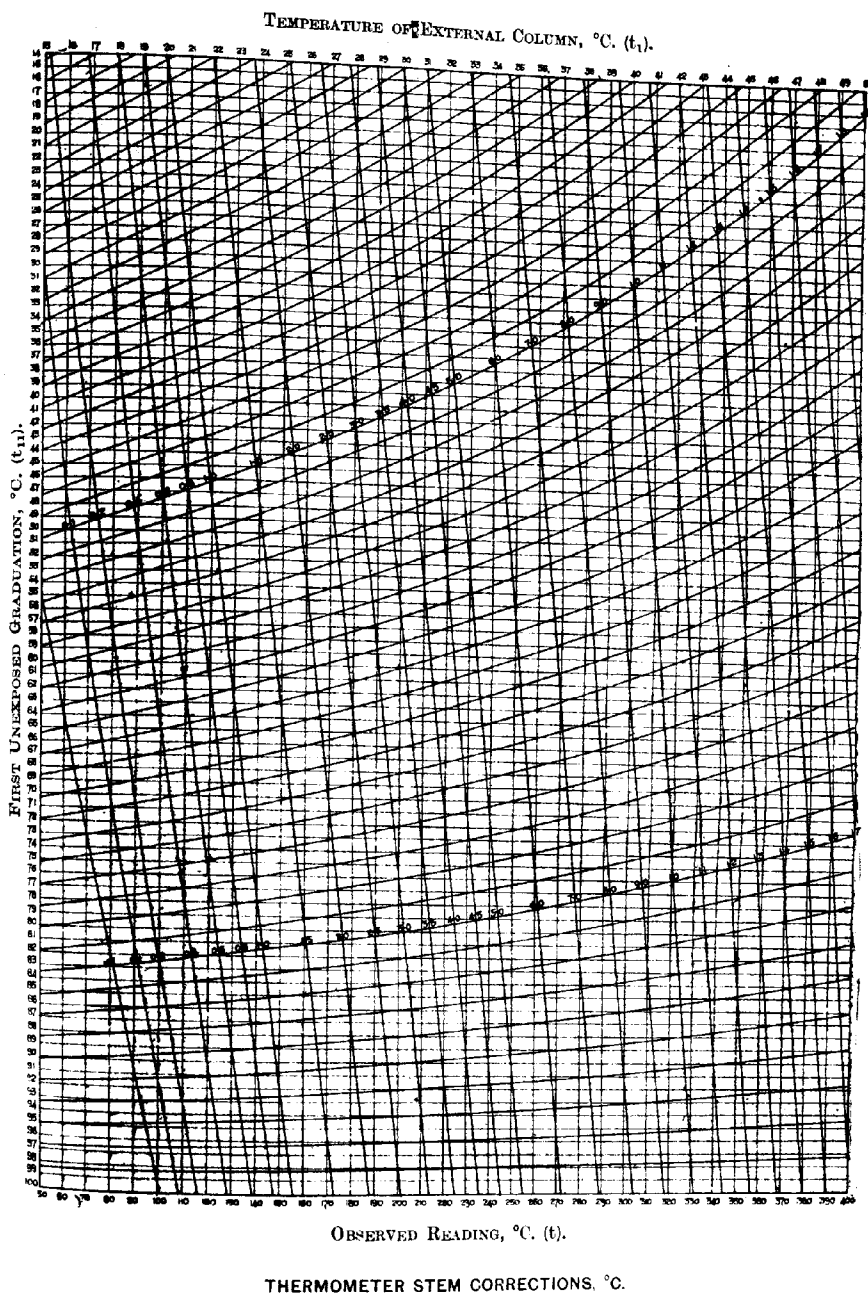
The following are two examples:—

If  $t = 200^\circ$ ,  $t_1 = 25^\circ$ , and  $t_{11} = 50^\circ$ , find the junction of the co-ordinates corresponding to the latter two values; move parallel to the thick curved lines to the junction with the ordinate of  $t = 200^\circ$ . This point will be seen to give a reading of  $C = 3.5^\circ$  on the thick slanting lines.

Again, if  $t = 300^\circ$ ,  $t_1 = 30^\circ$ , and  $t_{11} = 70^\circ$ , find the point whose co-ordinates are  $t_1 = 30^\circ$  and  $t_{11} = 70^\circ$ ; move parallel to the thick curved lines to the junction with the ordinate of  $t = 300^\circ$ . This point gives a reading of  $C = 8.9^\circ$  on the thick slanting lines.

The graph was plotted in the following manner:—  
Let  $C_{100}$  = the stem correction at  $100^\circ$  in  $C = K(t - t_1)(t - t_{11}) \therefore C_{100} = K(100 - t_1)(100 - t_{11})$ .  
By taking various even values for  $C_{100}$  in this equation corresponding values of  $t_1$  and  $t_{11}$  were calculated and plotted; this gave the curved lines which represent constant stem corrections at  $100^\circ$ .

The values of  $t$  and  $t_1$  were so plotted that the corresponding values on the same ordinates were connected by the equation,  $t_1 = \frac{t + 100}{10}$ .





By substituting  $t_1$  and  $t_2$  in the first equation, the following equation is obtained:

$$t^3 - \frac{9100}{9}t^2 - \left( \frac{10C_{100}}{K} + \frac{10C}{9K} - \frac{910,000}{K} \right)t + \frac{1000C_{100}}{9K} + \frac{1000C}{K} - 10^6 = 0$$

This is a cubic equation in  $t$ , which can be solved on giving particular values to  $C$  and  $C_{100}$ .

Taking the  $C_{100}$  lines as one axis, and the base line ( $t$ ) as the other axis, lines of equal stem correction can be plotted.

I have pleasure in recording my indebtedness to Dr. Percy E. Spielmann for his suggestions and continued interest.

### Industrial Notes.

#### DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

An announcement of the greatest importance to British industries was made in the Press on December 1st, to the effect that the Government have decided to establish a Department of Scientific and Industrial Research for Great Britain and Ireland, under the Lord President of the Council, with the President of the Board of Education as Vice-President. They have also decided, subject to the consent of Parliament, to place a large sum of money at the disposal of the new Department, to be used as a fund for the conduct of research for the benefit of the national industries on a co-operative basis.

The Board of Inland Revenue have decided, with the approval of the Chancellor of the Exchequer, that no objection shall be offered by their surveyors of taxes to the allowance, as a working expense for income-tax purposes, of contributions by traders to industrial associations which may be formed for the sole purpose of scientific research for the benefit of the various trades, and the allowance would be equally applicable as regards traders' contributions specifically earmarked to the sole purpose of the Research Section of an adapted existing association. In both cases the allowance would be subject to certain conditions, e.g., the association or the research section to be under Government supervision and the trader's contribution to be an out-and-out payment, made from his trade profits, and giving him no proprietary interest in the property of the association, etc.

In order to enable the Department to hold the new fund and any other money or property for research purposes, a Royal Charter has been granted to the official members of the Committee of the Privy Council for Scientific and Industrial Research, under the title of the "Imperial Trust for the Encouragement of Scientific and Industrial Research." The Trust is empowered "to accept, hold, and dispose of money or other personal property in furtherance of the objects for which it has been established, including sums voted by Parliament, to that end." The Trust can take and hold land, and can "accept any trusts, whether subject to special conditions or not, in furtherance of the said objects."

A substantial gift has already been made to the Trust by two members of the Institution of Mechanical Engineers for the conduct of a research in mechanical engineering to be approved by the Department, in the hope that this example will be followed by other members of the institution.

Mr. H. Frank Heath, C.B., has been appointed permanent secretary of the new Department, to whom all correspondence should be addressed until December 31st next, at the offices of the

Board of Education, Whitehall. On and after January 1st, 1917, all correspondence should be addressed to The Secretary, Department of Scientific and Industrial Research, Great George Street, Westminster, S.W.

On November 30th the Marquis of Crewe received a deputation from the Conjoint Board of Scientific Societies. The deputation, which numbered about 150 representatives of the various branches of science, was introduced by Sir J. J. Thomson, President of the Royal Society, and included, as representatives of this Society, Dr. Charles Carpenter, Sir Boverton Redwood, and Mr. Walter F. Reid.

Sir JOSEPH THOMSON said that the deputation desired to urge the importance of increased grants for scientific and industrial research. Research in pure science was of vital importance, and had led to a number of discoveries which had proved subsequently to be of the greatest practical value. The discovery of Röntgen rays, for example, arose from a research of a purely scientific character, undertaken with a view to elucidating the nature of electricity.

Research in applied science might lead to reforms, but research in pure science led to revolutions. The State could insure that professors and others engaged on purely scientific research could devote sufficient time to it, and that their income from the professorships was not so small that they had to spend their free time in undertaking work to enable them to live. To neglect pure science would be on a par with omitting to sow the seed on land on which a large amount had been spent in manuring and ploughing.

Sir Maurice Fitzmaurice, President of the Institution of Civil Engineers, and Prof. Brereton Baker, of the Imperial College of Science and Technology, also spoke.

The MARQUIS OF CREWE said that we had to provide for the new conditions which would arise in this country, and in the rest of the civilised world, when the war was concluded. The Government had been impressed by the need of coming further to the help of those who were engaged on research work in relation to industry. They had had to consider what could be done to assist the great staple industries of the country in developing systematic research on a large scale. There were cases in which an individual research worker needed a grant to enable him to go on at all, and a sum would be set aside for that purpose. There were some professional societies which stood in need of assistance from time to time to enable them to carry on research work, and this charge would also be met. There was, further, an area of research which paid nobody in the pecuniary sense for the time being, and in some of these cases it would be necessary to find the money from public funds. Then there were some researches which were so obviously of purely national importance that no one would be found to finance them if the Government did not do so. Here, again, the Government felt that public money ought to be applied in specific and selected cases.

The matter of scientific research applied to industry was, it was considered, one of the cases in which an exception might be made to the usual plan of procedure by annual estimates. Therefore the Chancellor of the Exchequer was prepared to advise the Government to devote a very large sum, generally estimated to meet the needs for this purpose for the next five years, on a scale which ought to enable them to spend certainly four and possibly five times as much on the co-operation between the Department and the different industries as had been spent for the whole purposes of research by vote hitherto.

They desired to see the creation or adaptation of trade associations on a large scale, which might be able to assess the contribution which the industry was able to make towards systematic research. In some cases it might be found advisable to form a series of distinct associations for research purposes. On the other hand, it was quite possible that an individual great firm having various activities might belong to several associations and make its contribution in respect of the particular class of research which might be proceeded with at a given time. These associations should as far as possible be placed under small committees of direction, including leaders of the particular business, men of science, and representatives of the skilled workers in different trades.

It was proposed to give some further help for technical instruction. The Government had arrived at the conclusion that the present regulations under which technical schools received public money were not quite up to date, and they were going to discuss with the local authorities concerned, and the governors of the schools, certain new draft regulations, which, it was hoped, would both simplify administration and stiffen up the instruction. A substantial addition would be made in the Estimates so as to permit of a levelling up of the grants to a reasonable figure, and also to make improved arrangements for the training of technical teachers, as well as to permit of scholarships being established to carry on selected industrial students to the Universities.

Referring to the work of the Coal Conservation Committee, Lord Crewe said he understood that that Committee and the Advisory Council had agreed upon a series of researches which were designed to establish, on a scientific basis, a systematic economy in the use of fuel. The research was to begin with a systematic survey of all the various coal measures in the United Kingdom. It was to examine and experiment on coal under various furnace tests, and the suitability of different kinds of coal to different processes of coking, and so forth.

Although, in the higher forms of discovery, we in this country were not prepared to yield the palm to any country in Europe or out of it, we felt that for many the path of scientific learning had not been made as easy as it ought to be. What was desired was to make the road easy for those sons and daughters of Britain who saw the beacons of science shining ahead of them on a high hill, which it was their life's work to climb.

#### BENZOL FROM COAL GAS.

The national demand for benzol and toluol in increasingly large quantities has met with a prompt response by a large number of gas undertakings in this country, who are removing these hydrocarbons from their gas by washing with oil. An interesting discussion on the subject took place at a recent meeting of the Southern District Association of Gas Engineers and Managers. Although certain difficulties have presented themselves, particularly in regard to naphthalene troubles, it was clearly shown that these difficulties are by no means insuperable. It is to be hoped that the practice of oil-washing will very shortly become almost universal, and that it will not be necessary for compulsory measures to be introduced as was advocated by some of the speakers. Even very small gas works are using this process of washing—works making from 10 to 20 million cubic feet per annum.

Oil washing takes place after the gas has been freed from ammonia. Creosote, anthracene oil, or gas-oil may be used. Dr. Colman's specification for creosote, as approved by the Department of Explosives Supply, is as follows:—sp.gr., 1.020

to 1.030 at 60° F.; tar acids, immaterial; should deposit no naphthalene on cooling to 55° F.; should not boil below 200° F.; and on distillation not less than 70% nor more than 80% should distil up to 300° C. This oil takes up from 3 to 4% of its bulk of benzol and toluol, which is subsequently removed by distillation.

As mentioned above, one of the chief troubles which has been met with in connection with the oil-washing process, is that due to naphthalene. With a wash oil containing an excessive amount (10–20%) of naphthalene, and gas at a high temperature, the naphthalene content of the gas may even be raised, but in general, with a wash oil containing about 5% of naphthalene, the amount of naphthalene in the gas is considerably reduced. The trouble in this case is caused by the fact that at the same time the naphthalene solvents in the gas are removed in even greater proportion than the naphthalene itself, and hence deposition in the mains will occur. This difficulty is got over by adding to the gas after oil-washing a sufficient amount of solvent to prevent the deposition of naphthalene before it reaches the point of use. Many solvents can be used for the purpose, but ordinary kerosene is the most easily obtainable. It can be introduced into the gas either as vapour, or in the form of a very fine mist, produced by spraying, but the mist must be fine enough to carry to the extremes of the district supplied. It is important that this addition of solvent should be made at the time oil-washing is adopted, and not deferred until naphthalene troubles appear.

Gas which has been freed from its benzol and toluol contents is naturally deficient in illuminating power, and cannot comply with the standards in this respect. To meet this difficulty the Government has given permission to gas companies to apply for powers to work to a calorific standard (see this J., 1918, 882).

Further particulars as to the process may be found in this Journal, 1915, pages 170, 481, 539, 1001, 1079; 1916, pp. 460, 682, 1146.

#### THE BRITISH COAL-TAR COLOUR INDUSTRY AND ITS DIFFICULTIES IN WAR TIME.

BY C. M. WHITTAKER.

In a lecture delivered before the Royal Society of Arts on December 6th, and reprinted in the Journal of that Society for December 8th (Vol. 65, pp. 61 *seq.*) reference was made to the initial success of the British dye industry following the discovery of mauve by Sir William Perkin in 1856. This success, however, was not maintained, chiefly due to lack of effort and was subsequently followed by a period of decline. Succeeding this period the dye industry was reanimated as a result of more enlightened management, and during the 14 years prior to the outbreak of war was able to offer competition to the German firms. Thus at the outbreak of war the British firms were a considerable national asset.

Certain statements which had been made concerning the lack of British enterprise in the distribution of circulars and pattern cards, and the failure to match colours, were shown to be without foundation, and reference was made to the fact that the hydrosulphite vat process for dyeing indigo, which was a French invention, was first introduced to the British dyers by Read Holliday and Sons, Ltd.

At the outbreak of war the consumer quickly realised his dependency upon German firms for supplies, and statistics were quoted to show that a very large percentage of the coal-tar colours imported by Great Britain were derived from Germany. Attention was drawn to the false

impression prevalent concerning the capital involved in the German dye industry and to disperse the existing delusion of the dependence of Germany upon outside sources for raw materials (see this Journal, 1916, 783).

Concerning the difficulties which beset the British coal-tar industry, mention was made of the scarcity of chemists experienced in large scale operations, and the diversion of many forms of labour to the manufacture of explosives. Again the bulk of raw material required for the manufacture of explosives is inseparably associated with the production of coal-tar colours, and in this statement lies the answer to the consumer who urges the early production of the commoner types of dyes, the manufacture of which has long been known and established.

Next in importance to the demand for explosives has been the urgent requirements of dyes for military purposes—requirements embodying those of the Allies apart from those of Great Britain. The quality of these dyes has been, contrary to various assertions, fully equal to that of the German colours. Under the extenuated circumstances of shortage of skilled controllers, of labour, and of material, it was gratifying to know that this huge demand had been successfully met, and the British colour industry had every reason to be proud of its achievement.

Reference was then made to some of the more important derivatives of benzene, toluene, and naphthalene used in the manufacture of dyes; this part of the subject has already been dealt with by the lecturer in the paper read before this Society (see this J., 1916, 784—786). In connection with the vat dyestuffs, a specimen was exhibited which had been dyed with Chloranthrene Blue (Indanthrene Blue), produced by British Dyes, Ltd.

Regarding the future of the British coal-tar colour industry, the hope is expressed that this industry will survive the peculiar difficulties which beset the initial stages of most British trades.

E. H. B.

#### DYESTUFF CENSUS OF THE UNITED STATES.

The United States consumes annually about 29,000 tons of dyestuffs, of which about 90% was imported before the war. The cessation of German imports in the early months of the war threatened the American textile industry with very serious dislocation unless a large output of dyes could be secured within a comparatively short time. The Bureau of Foreign and Domestic Commerce speedily realised that it would be of the greatest assistance to manufacturers if they were in possession of detailed particulars of the various kinds of dyestuffs normally consumed in the country, and therefore took active steps to complete a census of these products. It was early realised that it would be impracticable to obtain the necessary particulars from the numerous consumers—similar efforts in Great Britain resulted in a return of details of about 12% of the total consumption. The method adopted was to use the data furnished by the records of imports of artificial dyestuffs into the United States during the year ended June 30, 1914, adding to these figures the returns of the Bureau of the Census for the American coal tar industry for 1914. The import invoices contained entries under 5674 heads, each representing a distinct commercial designation. Many of these, however, were synonymous, and the list has been reduced as far as possible to correspond with the classification of Schultz and Julius' "Farbstofftabellen" (1914). A summary has been prepared, showing the amounts of the more important dyes consumed, namely, those of which more than 10,000 lb. was

imported in the year ended June 30, 1914. The summary is given here as, although it relates to the United States, it should be of great value to the other countries that are endeavouring to render themselves independent of foreign imports of dyestuffs.

#### Summary of the most important colours imported by U.S. during fiscal year 1913—14.

The abbreviation V.M. denotes "various marks." The serial numbers employed correspond to those found in Schultz's "Farbstofftabellen" (edition of 1914). Numbers preceded by letters refer to colours regarding the manufacture and chemical composition of which little or nothing is known. Azo dyes in this category are indicated by A, sulphur colours by S, and other dyestuffs of unknown composition by U.

CLASS I. (10,000 TO 100,000 lb.)

Serial No.	Commercial name.	lb.	Invoice value.
<b>Nitroso and Nitro Colours.</b>			
4	Naphthol Green .....	19,146	\$ 2,902
<b>Stilbene Colours.</b>			
9	Direct Yellow .....	71,399	11,295
9a	Naphthamine Yellow (V.M.) .....	42,180	6,748
9b	Direct Yellow (V.M.) .....	79,065	16,784
9g	Direct Yellow B .....	29,123	2,706
10	Stilbene Yellow .....	60,477	7,464
10a	Stilbene Yellow R.X. ....	34,568	6,305
11	Chloramine Orange .....	24,688	5,914
13a	Diphenyl Orange GG .....	18,646	3,538
14	Diphenyl Chrysoline .....	9,888	3,071
18	Diphenyl Fast Yellow .....	9,556	2,988
	<b>Total</b> .....	364,710	67,373
<b>Pyrazolone Colours.</b>			
19	Fast Light Yellow .....	33,614	10,272
20	Flavazine S .....	19,000	4,927
20a	Flavazine (V.M.) .....	62,376	10,700
22	Xylene Yellow .....	23,074	9,750
	<b>Total</b> .....	137,963	35,649
<b>Azo Colours.</b>			
33	Chrysoidine .....	63,303	8,565
37	Croceine Orange .....	11,366	1,535
38	Orange G .....	49,456	7,139
45	Brilliant Lake Red R. ....	31,874	2,337
50	Azul Red .....	49,847	5,379
58	Mordant Yellow .....	26,570	4,112
58a	Alizarin Yellow (V.M.) .....	59,000	7,976
58	Orange 13, 14 .....	10,974	2,634
61	Victoria Violet .....	47,126	10,968
63	Azo Acid Blue .....	44,268	3,644
64	Lanachrome .....	68,055	9,375
66a	Amido Naphthol Red .....	36,000	25,979
70	Brilliant Orange O .....	21,480	3,835
73	Helo Fast Red .....	13,413	2,141
73a	Lithol Fast Scarlet .....	36,295	9,287
80a	Wool Scarlet (V.M.) .....	39,888	6,283
82a	Ponceau (V.M.) .....	20,972	1,391
82a	Acid Anthracene Brown (V.M.) .....	30,655	7,392
96a	Chrome Fast Yellow .....	15,165	3,066
102	Diamond Flavine G .....	23,080	4,228
112	Bordeaux B .....	10,383	1,471
112a	Claret Red .....	14,338	1,291
118	Geranine .....	18,917	6,090
126a	Union Blue (V.M.) .....	16,353	2,118
132	Lake Red P .....	40,345	2,019
137	Acid Yellow .....	35,982	6,317
140	Orange IV .....	11,223	1,968
140	Curcumeine .....	39,269	6,257
141	Azo Yellow .....	59,894	13,755
141a	Azo Flavine (V.M.) .....	20,114	3,151
141b	Indian Yellow (V.M.) .....	10,537	2,392
146	Azo Fuchseine G .....	17,819	2,885
147	Azo Fuchseine 6 B .....	13,226	1,897
151a	Orange R O .....	20,174	7,363
162	Permanent Red 4 B .....	60,850	14,513
162a	Permanent Red (V.M.) .....	66,546	7,403
164	Palatine Chrome Brown .....	18,264	4,074
166a	Vigoureux Fast Black T .....	16,000	3,322
160	Fast Brown N .....	67,631	6,266
161	Fast Red A .....	46,850	2,427
163a	Carboline (V.M.) .....	17,107	19,873
163b	Chrome Blue (V.M.) .....	33,464	3,800
164a	Diamond Blue R .....	20,117	9,420
168	Amaranth .....	73,973	9,420
168b	Wool Red (V.M.) .....	11,497	2,255
169	Cochineal Red .....	29,984	3,669
173a	Lithol Red (V.M.) .....	67,615	11,280
177	Mordant Yellow .....	56,008	3,011
177a	Anthracene Yellow .....	16,060	3,395
177b	Sulphene Yellow .....	23,068	8,482
180	Eriochrome Blue Black B .....	18,860	

Serial No.	Commercial name.	lb.	Invoice value.	Serial No.	Commercial name.	lb.	Invoice value.
181	Salicine Black U	65,658	3	A108	Oxamine Dark Brown G. R.	10,590	8
184	Eriochrome Black A	96,570	10,906	A122	Palatine Chrome Blue BB	42,244	1,312
185	Anthracene Chrome Black	51,677	7,869	A124	Palatine Chrome Green G	19,965	4,670
186	Sulfone Acid Blue R	45,938	11,372	A131	Scarlet (V.M.)	80,778	6,452
189	Sulfone Acid Blue B	35,112	8,813	A142	Wool Scarlet (V.M.)	12,780	7,231
198	Thiamine Yellow	29,879	8,410	A144	Acid Black E. M.	15,660	1,417
211	Resorcin Brown	13,189	2,549	A147	Acid Chrome Black (V.M.)	39,508	2,021
212a	Acid Brown (V.M.)	14,705	3,228	A150	Acid Silk Black R	12,928	2,234
217	Agalma Black 10 B	40,763	7,518	A157	Benzo Chrome Black Blue B	51,315	9,904
217a	Agalma Black (V.M.)	13,465	2,359	A176	Benzo Dark Green B, G	13,038	2,123
217c	Naphthol Blue Black (V.M.)	42,864	8,847	A184	Benzo Green (V.M.)	13,018	5,541
217e	Acid Black (V.M.)	47,489	7,547	A191	Benzo Red 10 R, 12 B	10,420	2,950
217g	Wool Black (V.M.)	23,371	4,866	A203	Brilliant Fast 3 B, V	11,873	4,716
217h	Acid Wool Black	13,518	4,202	A210	Brilliant Fast Blue (V.M.)	11,553	3,300
220a	Amido Acid Black	32,824	3,614	A215	Cashmere Black 3 B, V	12,269	1,891
236	Wool Red	13,245	1,942	A227	Diazo Brilliant Scarlet (V.M.)	29,530	7,476
247	Scarlet	36,598	4,228	A242	Diazo Fast Black (V.M.)	12,048	2,019
257b	Tolyl Blue	18,750	2,967	A259	Helo Bordeaux BL	14,703	793
257c	Sulfon Cyanine Black	69,590	7,983	A266	Orange RO	24,288	2,246
260	Acid Black	35,662	5,745	A285	Phenylamine Black 4 B	14,066	1,619
272	Brilliant Black	39,454	5,588	A286	Pluto Black (V.M.)	30,010	6,034
272b	Wool Black (V.M.)	15,756	3,596	A292	Pluto Brown (V.M.)	14,580	2,542
275a	Chrome Black (V.M.)	72,521	13,616	A303	Alphanol Black (V.M.)	30,189	3,124
276c	Chrome Fast Black (V.M.)	35,999	10,532	A356	Azo Wool Violet (V.M.)	12,044	3,296
277	Anthracene Acid Black	17,793	2,847	A358	Diamine Catechine (V.M.)	68,876	14,942
279	Benzo Fast Scarlet	36,674	9,010	A364	Diamine Fast Blue (V.M.)	28,880	7,227
283	Bismarck Brown	27,576	5,352	A367	Diamine Fast Orange (V.M.)	17,357	4,519
286	Palatine Chrome Black	18,985	1,607	A368	Diamine Jet Black (V.M.)	14,091	4,315
296	Cotton Yellow	21,437	6,161	A382	Diamine Neron BB	36,982	6,204
308	Rend Brilliant Yellow	12,796	3,290	A384	Diamine Orange (V.M.)	17,068	2,851
307	Congo	12,040	1,667	A388	Oxy Diamine Brown (V.M.)	41,115	7,374
308	Diazo Black	62,854	8,267	A389	Oxy Diamine Carbon (V.M.)	23,488	3,810
312	Congo Corinth	39,748	6,030	A403	Para Diamine Black (V.M.)	18,634	2,090
313	Congo Rubine	46,113	6,329	A414	Salicine Blue B	16,224	8,449
319	Diamine Scarlet	28,887	9,027	A418	Amido Naphthol Black 4B, RK	10,750	1,219
326a	Oxy Diamine Violet	11,514	1,038	A430	Azo Acid Black (V.M.)	18,500	3,042
327	Diamine Violet N	12,467	1,552	A437	Fast Mordant Blue H, R	17,000	4,512
333	Devosil Black	13,107	2,849	A439	Naphthalene Blue B, DL	28,000	7,102
334	Diphenyl Blue Black	17,495	4,333	A444	Victoria Scarlet R, 3 R	22,400	2,379
335	Naphthamine Black	47,969	7,132	A451	Direct Green (V.M.)	31,194	5,091
337	Benzo Blue	19,035	789	A459	Heligoland Black FFN	25,132	4,151
338	Naphthamine Blue	11,707	2,455	A469	Oxychrome Brown (V.M.)	10,490	2,235
343	Diamine Fast Red	47,724	12,131	A478	Oxychrome Yellow (V.M.)	10,085	1,885
344	Diamine Brown	63,716	3,646	A485	Triazol Blue (V.M.)	10,148	1,580
346	Oxamine Red	11,636	2,568	A489	Triazol Brown (V.M.)	17,067	2,854
348	Diphenyl Brown BN	13,471	4,015	A515	Triazol Dark Blue (V.M.)	19,489	2,647
358	Diphenyl Red	12,808	5,001	A521	Brilliant Scarlet 2R, 4R	12,565	1,495
360	Pyramine Orange R	21,329	7,318	A524	Anthracyl Chrome Blue 2B, D	24,979	6,385
362	Oxydiamine Orange	19,805	4,223	A527	Crescine Scarlet MO, MOO	12,210	2,235
365	Benzoquinone (V.M.)	21,060	1,442	A531	Acid Blue Black	15,501	1,023
368	Dehtapurpleine 5 B	20,284	3,646	A532	Acid Chrome Blue	12,952	4,305
370	Brilliant Congo	19,133	3,133	A533	Acid Fast Green 8 B	11,050	7,068
384a	Diamine Blue (V.M.)	21,725	3,687	A541	Diazogene Black (V.M.)	30,042	6,813
392	Tolylene Orange	55,562	13,236	A550	Direct Black ABC, C	15,245	2,804
406	Acid Anthracene Red	17,560	5,174	A552	Direct Chrome Brown	12,178	2,065
408	Benzoquinone 10 B	47,708	11,181	A556	Drazaline Blue (V.M.)	10,831	1,325
410	Benzoquinone (V.M.)	73,699	21,018	A560	Drazaline Brown (V.M.)	21,756	4,977
416	Brilliant Carmine 5 G	18,385	3,206	A593	Drazaline Sky Blue FF	10,940	5,204
418	Diamine Brilliant Blue G	11,582	2,490	A600	Excoelior Black	59,955	10,090
419	Chicago Blue R W	15,176	3,364	A603	Hydrazol Black	10,981	1,621
421	Oxamine Blue B	14,091	2,436	A605	Hydrazol Chrome Black CB, DB	51,694	7,490
421a	Oxamine Blue (V.M.)	21,800	3,749	A612	Chicago Red III	13,195	2,420
428	Benzoquinone Pure Blue	12,881	5,663	A617	Diphenyl Blue (V.M.)	12,677	3,842
428a	Direct Blue (V.M.)	21,322	5,306	A622	Diphenyl Deep Black (V.M.)	21,098	4,216
449	Thionin Brown	16,781	5,255	A629	Diphenyl Green (V.M.)	18,021	4,697
456	Benzo Fast Blue	73,036	20,607	A661	Chlorantine Brown (V.M.)	18,267	4,054
456a	Benzo Fast Blue (V.M.)	26,559	8,439	A674	Chrome Fast Brown (V.M.)	12,204	3,560
462	Direct Deep Black E.V.	32,830	5,032	A682	Chrome Fast Green (V.M.)	12,943	0,676
462b	Cotton Black (V.M.)	91,485	22,206	A687	Cupranil Brown (V.M.)	24,851	4,360
462d	Union Black (V.M.)	61,218	9,044	A692	Direct Black E	22,223	4,205
469	Chloramine Black	20,065	5,378	A696	Direct Fast Black B	11,290	2,790
469a	Chloramine Black (V.M.)	19,565	3,951	A711	Azo Rhodine 2 B	10,108	2,621
474	Oxamine Green B	23,832	5,134	A719	Direct Sky Blue FF	58,838	12,627
474a	Diamine Green (V.M.)	53,368	8,318	A729	Azomine Milling Black N	22,500	5,124
476a	Benzoquinone Brown 3 G	16,988	2,470				
477a	Naphthamine Brown (V.M.)	48,734	9,452				
478	Columbia Green	24,749	4,723				
485a	Direct Green (V.M.)	19,313	4,291				
485b	Benzo Brown (V.M.)	41,965	7,125				
490a	Cotton Brown (V.M.)	23,975	5,207				
	Total	4,374,797	825,916				
Unclassified Azo Colours.							
A 8	Chrome Fast Black (V.M.)	76,451	10,172				
A 12	Columbia Brown (V.M.)	29,793	3,973	497a	Victoria Green	44,595	10,366
A 16	Chrome Fast Blue (V.M.)	84,661	18,879	499	Brilliant Green (V.M.)	73,904	16,345
A 28	Naphthogene Blue (V.M.)	33,447	6,824	502	Guinea Green	14,666	3,382
A 32	Nerol (V.M.)	65,441	9,751	502a	Acid Green (V.M.)	35,306	9,379
A 44	Columbia Blue B	21,704	3,376	503	Neptune Green (V.M.)	40,868	13,825
A 60	Corvan Black (V.M.)	10,033	1,870	505	Light Green (Yellowish) (V.M.)	24,946	5,900
A 71	Cotton Black (V.M.)	24,505	4,843	505a	Acid Green (V.M.)	46,461	28,174
A 81	Lithol Fast Orange R	36,641	4,381	506	Erioglaucine (V.M.)	86,526	28,971
A 88	Oxamine Black (V.M.)	10,472	10,472	512	Magenta	37,102	25,659
A 95	Oxamine Brown (V.M.)	93,454	22,569	516	Crystal Violet	35,653	13,044
A102	Oxamine Copper Blue RR	10,222	1,041	517	Violet (V.M.)	18,219	5,299
A104	Oxamine Dark Blue (V.M.)	23,810	4,246	518	Benzy Violet	22,387	8,019
				519	Ethyl Purple	51,933	23,101
				521	Aniline Blue	19,008	4,030
				524	Acid Magenta	13,078	4,302
				527	Acid Violet (V.M.)	16,106	5,360
				527a	Acid Violet (V.M.)		
					Total	2,269,308	462,932
					Triphenylmethane Colours.		
				497a	Victoria Green	44,595	10,366
				499	Brilliant Green (V.M.)	73,904	16,345
				502	Guinea Green	14,666	3,382
				502a	Acid Green (V.M.)	35,306	9,379
				503	Neptune Green (V.M.)	40,868	13,825
				505	Light Green (Yellowish) (V.M.)	24,946	5,900
				505a	Acid Green (V.M.)	46,461	28,174
				506	Erioglaucine (V.M.)	86,526	28,971
				512	Magenta	37,102	25,659
				516	Crystal Violet	35,653	13,044
				517	Violet (V.M.)	18,219	5,299
				518	Benzy Violet	22,387	8,019
				519	Ethyl Purple	51,933	23,101
				521	Aniline Blue	19,008	4,030
				524	Acid Magenta	13,078	4,302
				527	Acid Violet (V.M.)	16,106	5,360
				527a	Acid Violet (V.M.)		

Serial No.	Commercial name.	lb.	Invoice value.
528	Fast Acid Violet 10 B .....	12,019	8,229
530	Acid Violet .....	50,065	12,806
530a	Acid Violet (V.M.) .....	65,395	20,954
530b	Formyl Violet (V.M.) .....	19,819	4,185
530c	Guinea Violet 4 B, 6 B .....	18,854	5,114
531	Eriocyanine .....	25,091	11,987
534a	Acid Violet (V.M.) .....	19,960	6,910
537a	Navy Blue (V.M.) .....	31,499	8,275
538a	Cotton Blue (V.M.) .....	45,019	9,809
539	Soluble Blue .....	86,523	31,093
543c	Acid Blue .....	14,467	4,916
545	Patent Blue A .....	40,848	10,239
545a	Neptune Blue (V.M.) .....	10,765	2,505
545c	Brilliant Acid Blue (V.M.) .....	10,120	3,525
546	Cyanol .....	40,015	15,757
551	Eriochrome Azurol BC .....	21,070	14,480
Total		1,171,829	377,366
<i>Diphenyl-naphthyl-methane Colours.</i>			
544	Naphthalene Green .....	22,144	5,904
566	Wool Green S .....	33,863	13,526
566b	Cyanol Green (V.M.) .....	10,968	2,193
Total		66,995	21,623
<i>Xanthone Colours.</i>			
571	Rhodamine 6 G .....	37,490	18,495
573	Rhodamine B .....	58,339	23,777
576	Rhodamine 3 G .....	16,940	6,858
580a	Fast Acid Violet (V.M.) .....	19,811	13,975
587	Eosine .....	35,511	13,183
587a	Eosine (V.M.) .....	21,017	7,891
587b	Bromo-Fluorescein Acid .....	38,000	18,397
590a	Acid Eosine .....	17,499	7,388
599	Galleine .....	15,404	8,817
Total		259,981	118,781
<i>Acridine Colours.</i>			
606c	Patent Phosphine .....	23,627	17,881
606c	Leather Flavine .....	24,153	8,235
607	Rheoline .....	19,704	5,261
608	Euchrysine .....	15,403	5,343
609b	Diamond Phosphine .....	30,556	5,897
609c	Coriolavine .....	40,343	13,438
Total		158,566	56,055
<i>Quinoline and Thio benzoyl Colours.</i>			
612	Quinoline Yellow (acid-soluble) .....	79,553	28,170
613	Quinoline Yellow (water-soluble) .....	15,324	7,072
616	Primuline .....	56,212	8,478
617	Columbia Yellow (V.M.) .....	86,090	10,165
617a	Diamine Fast Yellow (V.M.) .....	88,688	12,972
618	Thioflavine T .....	31,714	17,683
Total		357,581	84,540
<i>Oxazine and Thiazine Colours.</i>			
627	Galloyanine .....	78,253	27,227
649	Cotton Blue (V.M.) .....	32,500	9,475
660	Methylene Green (V.M.) .....	30,812	13,196
661	Thionine Blue (V.M.) .....	18,618	7,873
663	New Methylene Blue (V.M.) .....	30,392	12,127
667	Indochromine (V.M.) .....	19,060	12,430
Total		209,644	82,528
<i>Azine Colours.</i>			
672	Azo Carmine .....	17,500	5,453
679	Sulfaniline (V.M.) .....	58,921	21,273
681	New Fast Gray (V.M.) .....	29,507	10,436
697	Induline, Soluble in Spirit (V.M.) .....	25,342	5,016
699	Induline, Soluble in Water (V.M.) .....	21,775	5,514
706a	Indocyanine B, 2 RF .....	23,138	5,205
Total		177,183	52,897
<i>Sulphur Colours.</i>			
708	Sulfaniline Brown O, R .....	11,327	1,158
710	Immedial Yellow D (V.M.) .....	13,305	2,266
725	Immedial Brown (V.M.) .....	23,887	2,558
726	Pyrogene Blue (V.M.) .....	10,924	2,582
734	Pyrogene Yellow M, O .....	18,515	5,102
735	Pyrogene Indigo (V.M.) .....	22,661	6,652
739	Immedial Maroon B .....	15,496	2,585
746	Katigene Green (V.M.) .....	63,929	9,960
750	Kryogene Brown A, G .....	10,313	972
Total		190,457	34,125
<i>Unclassified Sulphur Colours.</i>			
8 3	Sulfur Blue (V.M.) .....	73,434	15,489
8 12	Sulfur Brown (V.M.) .....	79,691	9,505
8 13	Sulfur Orange G, R .....	48,973	5,071
8 26	Sulfur Indigo (V.M.) .....	10,468	2,085
8 37	Katigene Black Brown (V.M.) .....	11,006	1,386
8 45	Katigene Brown 2 R, V .....	22,811	2,452

Serial No.	Commercial name.	lb.	Invoice value.
8 40	Katigene Direct Blue, B, RF .....	11,299	2,306
8 51	Katigene Indigo (V.M.) .....	42,157	6,224
8 55	Katigene Khaki G .....	14,242	1,601
8 58	Katigene Red Brown B, 3 R .....	88,864	9,386
8 62	Katigene Yellow G, GG, GE .....	55,237	9,318
8 65	Katigene Yellow Brown (V.M.) .....	36,826	11,145
8 75	Immedial Direct Blue (V.M.) .....	73,892	13,141
8 70	Immedial Indogene (V.M.) .....	90,077	13,141
8 78	Immedial New Blue G .....	37,492	10,016
8 84	Sulfur Brown .....	12,735	1,926
8 86	Thion Brown (V.M.) .....	18,579	2,824
8 87	Thiogene Blue (V.M.) .....	14,344	2,261
8100	Thiogene Brown (V.M.) .....	97,551	10,601
8109	Thiogene Deep Blue .....	18,106	3,049
8155	Pyrogene Brown (V.M.) .....	68,450	6,689
8188	Sulfur Bronze .....	15,152	1,392
8177	Cross Dye Drab N .....	15,758	1,324
Total		927,154	134,547
<i>Anthraquinone and Allied Colours.</i>			
760	Indanthrene Gold Orange G .....	20,092	10,088
761	Indanthrene Gold Orange .....	50,496	2,052
763	Indanthrene Dark Blue BO .....	11,096	2,516
765	Indanthrene Green B .....	73,227	18,377
767	Indanthrene Violet RR .....	68,419	21,516
768a	Indanthrene Black B, BB .....	50,034	12,876
774b	Alizarin Black (V.M.) .....	61,187	10,239
779	Alizarin Orange (V.M.) .....	14,239	3,184
780	Alizarin Red .....	53,154	24,784
780a	Alizarin Red (V.M.) .....	28,775	3,708
785	Alizarin (V.M.) .....	40,021	5,379
790a	Anthracene Blue (V.M.) .....	22,444	7,174
800	Anthracene Blue WB, WG .....	54,712	9,228
803	Alizarin Blue WX, A .....	16,575	6,453
804	Alizarin Blue S .....	79,679	69,871
804a	Alizarin Blue SB, 942 .....	12,409	6,158
804c	Alizarin Sky Blue B .....	19,471	24,555
806	Alizarin Green S .....	15,885	2,497
807a	Patent Alizarin Black (V.M.) .....	61,500	10,049
808	Alizarin Green S .....	11,096	2,337
810a	Helindone Yellow CG .....	20,744	6,954
820	Algol Brilliant Violet R .....	12,784	3,623
827	Indanthrene Claret B .....	23,728	9,923
832	Indanthrene Violet RN .....	11,667	5,181
833	Algol Olive R .....	13,334	2,850
841	Indanthrene Blue GGS .....	10,163	4,284
849	Indanthrene Yellow G, GP .....	12,683	4,353
849a	Indanthrene Violet Yellow GP .....	62,509	20,738
860a	Indanthrene Blue WR .....	31,658	4,272
851a	Alizarin Direct Blue (V.M.) .....	10,201	11,878
856a	Alizarin Rabinol B .....	10,917	11,826
859	Cyananthrol R .....	18,792	27,555
862	Alizarin Blue Black B, 3B .....	54,706	61,870
Total		1,071,597	454,348
<i>Indigo and its Derivatives.</i>			
877	Indigo Extract .....	12,320	6,577
879	Indigo MLB .....	50,410	11,064
881	Ciba Blue 2 B .....	16,880	7,423
886	Brilliant Indigo GD .....	12,057	1,747
888	Indigo MLB, T .....	12,730	1,538
901	Ciba Violet B .....	19,830	6,975
904	Helindone Brown G .....	12,936	6,710
907	Ciba Scarlet G .....	22,265	11,479
910	Helindone Pink (V.M.) .....	39,393	47,117
913	Helindone Orange R .....	14,489	5,841
918	Helindone Red 3 B .....	27,874	10,942
920	Helindone Violet B, 2 B, R .....	28,007	15,945
Total		230,000	133,958
<i>Aniline Black group.</i>			
923	Ursol .....	53,720	15,779
<i>Unclassified Coal-Tar Colours.</i>			
Include imported artificial colours, the composition or manufacture of which are not known and which have not been mentioned among the unclassified azo colours and sulfur colours.			
U 20	Guinea Bordeaux (V.M.) .....	23,252	3,233
U 24	Indo Violet B .....	23,060	4,647
U 27	Metachrome Blue B, G .....	14,301	3,996
U 31	Metachrome Brown B, BRL .....	57,313	7,271
U 61	Scarlet 53446 .....	13,344	1,846
U 78	Chrome Fast Blue 4 B .....	23,535	6,138
U 86	Columbia Fast Black (V.M.) .....	32,040	15,756
U100	Basic Kraft Brown Y 2 .....	11,235	2,039
U109	Brilliant Scarlet (V.M.) .....	33,382	2,568
U121	Corviline BT .....	10,789	3,241
U138	Fast Acid Marine Blue HBB .....	25,567	6,215
U145	Japan Black (V.M.) .....	13,974	2,765
U151	Jet Black APX, R .....	19,442	4,779
U155	Kraft Brown L, Y .....	32,907	10,273
U158	Leather Black BC, CB .....	18,433	4,843
U163	Oil Black 6 B, 6 G, RG .....	28,603	4,258
U180	Pigment Black .....	23,448	929

Serial No.	Commercial name.	lb.	Invoice value.
U183	Quercitron Substitute WBL, V	16,812	\$ 2,422
U192	Thiazine Brown R	12,105	2,809
U206	Acid Chrome Blue 3 G, 2 R, 5 R	25,633	6,553
U217	Blue 27021	14,775	994
U238	Claret Lake BL	15,200	949
U246	Half Wool Blue 3 E	20,610	3,790
U271	Wool Fast Blue BL, GL	19,246	6,331
U279	Brilliant Lanafuchaine (V.M.)	11,289	1,757
U283	Brilliant Scarlet (V.M.)	41,082	4,317
U290	Leather Black (V.M.)	11,784	3,063
U293	Noradine G, GA	44,676	8,484
U304	Acid Red (V.M.)	30,099	6,238
U321	Carpet Red B, BT, E	15,445	1,640
U329	Cotton Brown (V.M.)	15,079	4,950
U332	Cotton Marine Blue 4676	79,035	10,902
U333	Cotton Orange (V.M.)	21,665	5,416
U335	Direct Black (V.M.)	42,277	8,438
U336	Direct Blue (V.M.)	57,224	14,318
U337	Direct Brown (V.M.)	21,828	4,700
U361	Naphthamine Fast Black, SE, SDE, VE	34,203	10,671
U378	Paper Scarlet (V.M.)	24,372	3,161
U385	Scarlet (V.M.)	29,634	3,563
U391	Wool Blue (V.M.)	23,020	6,854
U393	Wool Brown (V.M.)	40,736	6,333
U394	Wool Corbis SE	16,038	2,359
U395	Wool Green	20,255	5,488
U397	Wool Violet R, SL	12,584	3,429
U399	Wool Yellow (V.M.)	17,465	2,629
U423	Alizarin Pure Blue DPH	31,000	7,349
U440	Hansa Yellow G, 5 G, R	11,014	4,559
U460	Paratol Chrome Yellow L	17,336	1,238
U465	Paratol Scarlet 3 B	41,000	8,271
U470	Rosadine B, B E, 6 G	17,509	5,536
U510	Cresol Black (V.M.)	37,322	4,248
U528	Chrysoline A	15,756	5,575
U553	Black BH, HB	21,239	4,780
U570	Developed Black B, N, R, W	36,475	9,501
U610	Erio Violet BC, RLC	21,345	6,117
U682	Sepia Black FV	10,527	2,367
U687	Soligene Deep Black (V.M.)	61,949	9,509
U695	Blue (V.M.)	13,657	3,827
U701	Calcutta Blue 2	26,669	4,960
U708	Meridian Black AR, AN	15,157	3,318
U711	Omega Chrome Cyanine R	21,001	3,019
U716	Alpha Black JC, 6 BN	12,100	2,949
U731	Cachou (V.M.)	56,991	3,430
U744	Alizarin Black M	18,979	1,968
U770	XL Blue (V.M.)	10,047	2,126

Total 1,683,921 323,511

Class II. (100,000 to 200,000 lb.)			
34	Chrysoline R	105,946	16,852
48	Alizarin Yellow	144,761	11,118
145	Orange II	127,550	10,116
163	Azo Rubine	160,232	23,409
181b	Salicine Black (V.M.)	177,203	29,945
183	Eriochrome Black T	129,550	23,447
217d	Naphthylamine Black (V.M.)	122,581	12,240
217f	Amido Black (V.M.)	105,005	10,062
220	Palatine Black	148,203	15,169
220b	Wool Black (V.M.)	110,244	16,568
227	Brilliant Crocine	123,068	20,333
257	Sulfon Cyanine	128,044	21,118
266	Naphthylamine Black	152,141	21,903
269a	Naphthol Black (V.M.)	131,890	19,436
284	Bismarck Brown 2 R	170,882	31,241
304	Chrysophenine	148,406	40,466
323b	Diamine Black (V.M.)	171,211	19,634
424	Chicago Blue 6 H	116,560	32,417
436a	Dianol Black	112,095	12,835
442a	Direct Black (V.M.)	145,738	11,831
455a	Columbia Black (V.M.)	143,956	26,125
462f	Carbide Black (V.M.)	190,304	31,607
A199	Benzo Fast Black L	100,268	22,846
A382	Oxy Diamine Black (V.M.)	146,620	24,836
A387	Oxy Diaminogen (V.M.)	139,118	26,832
495	Malachite Green	116,831	43,563
543	Patent Blue	114,631	49,945
558	Victoria Blue R	109,627	33,117
565a	Wool Blue (V.M.)	173,904	18,406
606	Phosphine	101,853	30,442
659	Methylene Blue (V.M.)	185,738	72,619
698	Nigrosine, Soluble in Spirit (V.M.)	186,540	29,435
774	Alizarin Black 5, BE, NE	136,461	9,936
782	Alizarin Brown (V.M.)	119,211	36,907
789	Anthracene Blue WE	107,778	13,622
807	Alizarin Black 8	198,491	19,902
808a	Alizarin Green (V.M.)	124,095	58,491
858	Indanthrene Blue RS	187,379	56,532
U 64	Amine Black (V.M.)	146,163	14,806
U390	Wool Black (V.M.)	118,791	20,453
U799	Black (V.M.)	138,805	14,781

Total 5,771,798 1,039,821

Class III. (200,000 to 300,000 lb.)			
	Naphthol Yellow	250,400	24,702

Serial No.	Commercial name.	lb.	Invoice value.
23	Tartrazine	265,781	\$ 53,137
134	Metanil Yellow	284,606	46,614
157	Diamond Black	285,047	37,055
173	Lithol Red R	214,448	18,550
174a	Scarlet	209,231	20,472
303a	Paper Yellow (V.M.)	264,443	45,320
436	Columbia Black	290,902	41,563
463	Cotton Black E	248,597	34,602
515	Methyl Violet	255,063	65,183
536	Alkali Blue	286,531	117,935
748	Hydron Blue (G, R)	292,720	39,555
778	Alizarin (Synthetic)	302,392	20,466
806a	Alizarin Black (V.M.)	229,500	33,275
Total		3,579,699	589,858
Class IV. (300,000 to 400,000 lb.)			
274	Lake Red C	306,607	9,495
275	Diaminogen	305,944	56,201
363	Benzopurpurine 4 B	351,582	55,020
A396	Cotton Black (V.M.)	341,724	45,233
A432	Lake Red (V.M.)	349,380	44,567
503a	Nigrosine, Sol. in Water	394,718	58,903
	Alizarin Blue (V.M.)	302,319	69,712
Total		2,652,747	348,913
Class V. (400,000 to 500,000 lb.)			
333	Oxamine Black	417,423	57,464
493	Aramine	449,276	107,887
842	Indanthrene Blue GCD	478,980	169,780
Total		1,345,679	335,131
Class VI. (over 500,000 lb.)			
462a	Direct Deep Black E	862,601	110,009
A 46	Zambesi Black (V.M.)	629,359	107,660
720	Sulfur Blacks (V.M.)	5,615,458	553,909
874	Indigo, Synthetic	8,507,359	1,090,733
Total		15,614,777	1,867,320

Grand Total 42,839,062 lb. \$7,445,263

THE CARGO OF THE SUBMARINE  
"DEUTSCHLAND."

On July 10th the mercantile submarine "Deutschland" arrived in Baltimore with 750 tons of medicinal and coal-tar dye products. It appears that the weight of dyes in the consignment was 125 tons, and that they consisted mainly of Anthracene and Alizarine derivatives, which are patented in Germany and have not yet been prepared in the United States. A circular prepared by the Badische Company of New York states that these dyes have been prepared in a highly concentrated form, in a few cases twelve times their normal strength. They are offered in America at the following prices, per lb. f.o.b. New York:—

Euchrysin G.X., \$8.50; Rhodamine B. extra (1 lb.=5 lb. B.), \$12; Safranin T, extra conc. (80 lb.=100 lb. T.K.), \$7.35; Diamond Green G.K., \$8.50; Anthraquinone Green, G.X.H.O., patented (2 lb.=3 lb. G.X.N.), \$9.50; Anthraquinone Violet, \$11; Anthraquinone Blue Green, B.X.O., patented (2 lb.=3 lb. B.X.), \$9.50; Cyananthrol R.B.X., patented (7 lb.=10 lb. R.B.), \$16.50; Indanthrene Blue R.S. Powder, triple, \$10.50; Indanthrene Blue, G.C.D. Powder, patented (8½ lb.=106 lb. paste), \$56; Indanthrene Violet R.R., extra, Powder, patented (12½ lb.=100 lb. paste), \$70; Indanthrene Black B.B. Powder, patented (12½ lb.=100 lb. paste), \$28; Anthracene Blue S.W.G. Powder, \$15; Anthracene Blue S.W.G.G. Powder, \$10; Anthracene Blue S.W.G.G. extra Powder, \$16.50; Alizarine Blue S. Powder, \$8.75; Anthracene Blue S.W.R. Powder, \$15; Oxamine Blue A. extra (2 lb.=5 lb. A.), \$5.15; Indigo White 50%, \$4.50.

Vide Chem. Ztg., 1916, pages 610, 834 and 849.

## Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—  
*English*.—6d. each to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.  
*United States*.—1s. each to the Secretary of the Society, who has to furnish the U.S. Patent Office with the following data:—Patent number, date, name of patentee, and title of invention.  
*French*.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56 Rue Feron 8, Paris (Se.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

### I.—GENERAL; PLANT; MACHINERY.

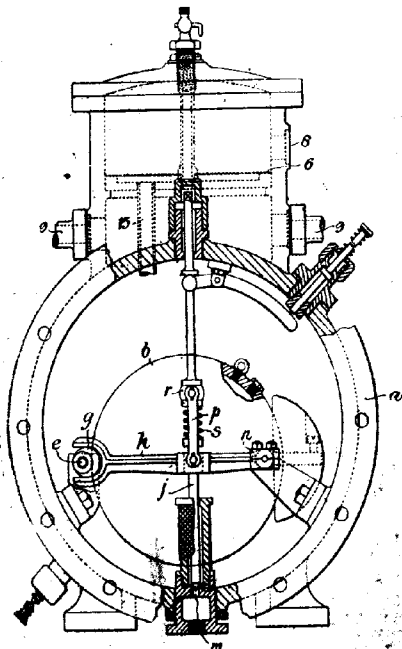
#### PATENTS.

*Separating solids from suspension in liquids; Method of — and apparatus therefor.* W. J. Gee, London. Eng. Pat. 9365, June 25, 1915.

THE liquid is fed into a vertical rotating cylindrical vessel provided with radial blades extending inwards, and an annular cover with a central opening for the admission of liquid and for the maintenance of a column of rotating liquid of fixed radial thickness. The lower half of the casing contains a filtering drum mounted on the same shaft and having a diameter greater than that of the opening in the cover, the lower parts of the radial blades being cut away to accommodate it. The heavier solids are deposited on the inner walls of the outer vessel and the lighter solids are deposited on the outer wall of the filtering drum, as the liquid passes through under pressure and is discharged by passages just within the periphery. When the layer of solids deposited on the filtering drum exceeds a certain thickness, the material is thrown off by centrifugal force and deposited on the walls of the outer vessel.—W. F. F.

*Separating fluids of different specific gravities; Apparatus for —.* J. S. Gander, London. Eng. Pats. 12,635, Sept. 2, and 14,223, Oct. 7, 1915.

THE mixture to be separated enters by the passage, 8, and passes through the filter, 6, and pipe, 15, to the separating vessel, a. A cylindrical float, b,



which sinks in the lighter liquid and rises in the heavier, is mounted on a shaft, e, carrying a

cam, g, so that when the float rises the forked lever, h, pivoted at n, is lifted. This lever is connected to the valve spindle, j, through links, p, sleeve, r, and spring, s, so that the heavier liquid is discharged through the passage, m, when the float rises. The lighter liquid rises and is discharged through the outlet, 9. The apparatus is suitable for separating oil and water, or by inverting it, for separating gases from oils or other liquids. To separate a mixture of gas, oil, and water, the mixture is passed first through the apparatus as described to remove water, and the remainder through a similar apparatus, inverted at a higher level, to separate the gas and oil.

W. F. F.

*Gases or gaseous substances; Process for the separation of suspended impurities from —.* W. E. Mouldale, Liverpool. Eng. Pat. 14,806, Oct. 20, 1915.

PART of the gas to be treated passes by suction or pressure through a perforated pipe immersed in a froth-forming liquid in the bottom of the washing chamber. The main portion of the gas passes through the froth thus produced in a tortuous path formed by means of vertical baffle-plates. The gas with part of the froth passes to a separator comprising a chamber provided with vertical baffle-plates, and having a sprinkling device above to break up the froth and remove the solid material. A preliminary washing chamber may also be used for a rough separation, in which the froth is broken up by a sprinkling device.—W. F. F.

*Condensing apparatus and the fittings for use therewith.* Hick, Hargreaves & Co., Ltd., and J. Gunn, Bolton, Lancs. Eng. Pat. 16,918, Dec. 1, 1915.

THE invention relates to steam condensing plant of the kind in which a common outlet for the water, vapour, and air is provided, the water being withdrawn by a pump and the vapour and air through a branch pipe by an ejector. Water is withdrawn by a small pipe connected with the discharge side of the water pump and passed through a cooling coil in the condenser to a spraying nozzle in the air and vapour discharge pipe, so that the water flows back to the main water discharge pipe of the condenser. The cooling coil is attached to the inner side of the inspection door or it may be within the condenser in front of the door.—W. F. F.

*Condenser.* G. I. Vail, Denver, Colo. U.S. Pat. 1,199,945, Oct. 3, 1916. Date of appl., July 2, 1912.

THE condenser consists of a hollow cylinder provided with an inlet for the vapour and an outlet for the condensed liquid. The peripheral wall of the cylinder is formed of thin metal so that a pulsating movement is set up owing to the expansion and contraction caused by alternate heating and cooling. The extent of the inward pulsating movement is limited by a framework adjusted by set screws. The effect of the pulsating movement is to crack off and prevent the accumulation of scale on the exterior of the cylinder over which the cooling water flows.—W. H. C.

*Condenser.* B. S. McClellan, Chicago, Ill. U.S. Pat. 1,201,208, Oct. 10, 1916. Date of appl., Jan. 4, 1915.

THE fluid to be cooled enters at the top of a pipe coil enclosed in a cylindrical casing and is trans-

ferred at the bottom into the space between the above casing and a surrounding concentric casing from which it is discharged at the top. The cooling fluid passes through the inner cylinder from end to end, in contact with the pipe coil.  
—W. F. F.

*Mixing liquids and other substances; Apparatus for — and for heating or cooling same during the mixing operation.* J. C. Nicholl, Bradford. Eng. Pat. 101,731, Jan. 17, 1916. (Appl. No. 703 of 1916.)

THE apparatus consists of an annular vat provided with stirring gear and jacketed both on the inside and outside.—W. H. C.

*Mixing liquids; Method and apparatus for —.* J. A. Porter, St. Louis, Mo. U.S. Pat. 1,202,421, Oct. 24, 1916. Date of appl., July 30, 1915.

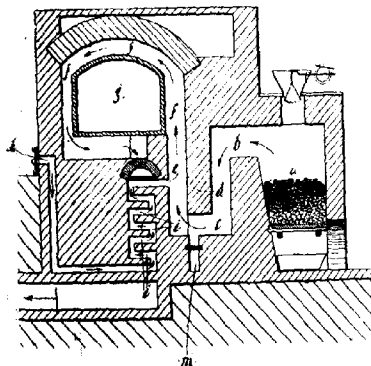
A PREDETERMINED proportion is removed from a stream of liquid, the portion so removed being proportional to the flow of the main portion of liquid. The portion of liquid removed is then mixed with any desired proportion of a reagent, and the mixture returned to the main stream of liquid.—W. H. C.

*Kneading and mixing machine.* R. Herbst and A. Bartosch, Halle, Germany. U.S. Pat. 1,201,298, Oct. 17, 1916. Date of appl., July 30, 1914.

THE apparatus consists of a kneading trough into which one end of a bent kneading lever depends. The other end of the lever is connected by pins working in a grooved ball with a horizontal crank device.—W. H. C.

*Furnaces.* C. H. Thompson, Amblesote, Worcester. Eng. Pat. 101,757, Mar. 21, 1916. (Appl. No. 4167 of 1916.)

A GAS producer, demi-gas producer, or fire-mouth, *a*, is connected by a passage, *b*, to a chamber, *c*, provided with a partition, *d*. The gas passes



thence to a combustion space, *f*, surrounding the muffle, *g*. Air enters by a suitable regulator at *h*, is heated by passing through a tortuous passage, *i*, having intermediate heating passages (not shown) through which the combustion gases pass in the opposite direction, and enters the combustion space through *e*. An additional supply of heated air may be introduced at *m*. The muffle may be replaced by an open flame furnace. The invention is applicable to the heat treatment of chemicals, such as the production of anhydrous barium oxide from the carbonate and tin oxide from the metal, the production of lead silicates and potters' glazes, the annealing of malleable iron castings, the enamelling of steel and iron hollow-ware

sheets or the like, the close annealing of metal articles, and the firing of pottery, china, and the like.—W. F. F.

*Furnace.* J. McKenna, Assignor to The Fort Wayne Rolling Mill Corporation, Fort Wayne, Ind. U.S. Pat. 1,199,091, Sept. 26, 1916. Date of appl., Apr. 22, 1915.

THE air for combustion is passed through a system of pipes contained in a brick chamber built in front of the combustion chamber and separated therefrom by a perforated wall. The chamber is provided with a separate stack and damper and is heated partly by radiation from the combustion chamber and partly by hot gases. The heated air is discharged into the combustion chamber through perforated pipes covered with coke breeze on the hearth of the combustion chamber. Fuel gas is supplied to the combustion chamber through a conduit which passes through the heating chamber and which is also in communication with the system of pipes.—W. H. C.

*Kiln.* J. Ralston, Grant Park, Ill. U.S. Pat. 1,200,132, Oct. 3, 1916. Date of appl., June 30, 1915.

THE kiln is provided with two furnaces at opposite sides beneath the kiln chamber, and the products of combustion pass up spaces formed between the outer end walls of the kiln and inner walls spaced apart from the outer walls and extending upwards to a point near the roof of the kiln. The hot gases are then deflected downwards on to the floor of the kiln and pass away to the stack through openings in the side walls provided with dampers.—W. H. C.

*Furnace.* C. A. Cadwell, Assignor to The Electric Railway Improvement Co., Cleveland, Ohio. U.S. Pat. 1,200,466, Oct. 10, 1916. Date of appl., Jan. 26, 1914.

THE furnace chamber is provided with a tapering lateral extension having adjustable transverse slits on its under side and a fuel-injecting nozzle at its opening. The fuel supplied to the nozzle is preheated by passing it through a coil embedded in the walls of the furnace but not in contact with the combustion gases. Part of the coil is flush with the top horizontal surface of the furnace wall, and may be protected wholly or partly, by lowering or raising the cover, so as to vary the heating of the fuel supply.—W. F. F.

*Heating element [for evaporators].* P. J. Sullivan, East Orange, N.J. U.S. Pat. 1,199,315, Sept. 26, 1916. Date of appl., Aug. 18, 1913.

A HEATING element for an evaporator is formed of a series of compound tubes. The outer tube, through which the heating agent is passed, is formed with a constricted upper end so that it can slide upon the lower portion of the inner tube. The liquid to be evaporated is supplied to the inner tube, the upper portion of which, above the outer tube, is enlarged and perforated. The loose sliding joint allows for thermal expansion of the tubes, and any vapour from the heating fluid escapes and mingles with the vapour driven off from the liquid undergoing evaporation.—W. H. C.

*Absorption; Process of — and apparatus therefor.* N. H. Hiller, Carbondale, Pa. U.S. Pat. 1,199,380, Sept. 26, 1916. Date of appl., Dec. 26, 1913.

THE gas to be absorbed is drawn into the absorbing conduit by a jet of the liquid in which it is to be absorbed. The absorbing conduit is cooled externally, and a portion of the strong liquor is returned to the inlet end of the apparatus so that the latter may be maintained full of a mixture of gas and liquid.—W. H. C.



**Absorption refrigeration apparatus.** N. H. Hiller, Carbondale, Pa. U.S. Pat. 1,199,381, Sept. 26, 1916. Date of appl., Feb. 21, 1916.

THE solution in which the gas is absorbed is heated in successive stages to progressively higher temperatures, the evolved gas passing from each section of the generator to the corresponding section of a multiple absorber and condenser. The weak liquor from the last section of the generator is passed into the first section of the absorber and so on from successive sections.—W. H. C.

**Refrigerating apparatus; Surface condenser for** ——. W. Schäfer, Dirmingen. Ger. Pat. 294,281, Nov. 17, 1914.

THE lower part of the condensing coil is connected to one end, and the upper part to the other end of a tall U-tube, and the inlet pipe for the vapour to be condensed opens into the shorter limb of the U-tube just above the bend. The vapour enters under pressure and, in consequence of its low density, rises in the limb of the U-tube, displacing the condensed liquid therein, a column of alternate layers of vapour and liquid being formed. In consequence of the pressure of the vapour, a vigorous circulation is produced, upwards through the condensing coil and downwards through the other limb of the U-tube, and this results in efficient transmission of heat from the vapour to the walls of the condensing coil. A valved outlet pipe is provided at the bend of the U-tube for withdrawal of the condensed liquid.—A. S.

**Heating and cooling liquids; Apparatus for** ——. H. Feldmeier, Assignor to D. H. Burrell and Co., Little Falls, N.Y. U.S. Pat. 1,109,974, Oct. 3, 1916. Date of appl., July 21, 1914.

THE liquid to be treated is contained in an elongated, trough-shaped vessel provided with a removable cover and a reciprocating agitator, and surrounded by an outer casing spaced apart from the trough. The heating or cooling liquid is sprayed on to the upper part of the exterior walls of the trough, trickles down, and collects in the lower part of the outer casing, and is then conveyed back to the spraying device.—W. H. C.

**Liquids; Method and apparatus for drying** ——. E. M. Johnson and E. J. Collings, Assignors to Mead Johnson and Co., Jersey City, N.J. U.S. Pats. 1,200,116 and 1,200,117, Oct. 3, 1916. Dates of appl., Mar. 8 and Oct. 9, 1915.

THE solid constituents of liquids of varying adhesiveness are obtained in a mixture of given proportions by spraying the liquids successively on a drying roller and removing the dried material by scraping. The liquids are sprayed by rotating rollers dipping in troughs containing the liquids and arranged close to the drying roller in such order that the less adhesive liquids are applied first.—W. F. F.

**Dryer.** W. D. Althouse, Norristown, Pa. U.S. Pat. 1,201,131, Oct. 10, 1916. Date of appl., Nov. 15, 1915.

THE material is carried by an endless belt through a horizontal chamber, of which the roof is higher at the receiving end than at the delivery end. Large heating flues are arranged on the floor at the receiving end and smaller flues near the roof, while the upper part of the travelling belt passes between the two. Air passes through the chamber, the flow being regulated by a curtain at the delivery end.—W. F. F.

**Still.** R. A. Waxler and E. Sepp, Lawrenceville, Ill. U.S. Pat. 1,200,241, Oct. 3, 1916. Date of appl., Nov. 30, 1915.

A NUMBER of vertical tubes are arranged in a

heating chamber between the fire-box and the flue, and are connected with tanks above and below, which are out of contact with the chamber. Each tube is scraped internally, to remove deposits, by mechanically operated rods carrying perforated discs.—W. F. F.

**Emulsifier. Method of emulsifying liquid.** R. L. Williams, Brighton, Mass., Assignor to J. W. Davies, Reading, Mass. U.S. Pats. 1,200,559 and 1,200,560, Oct. 10, 1916. Dates of appl., Aug. 2, 1913 and Mar. 16, 1914.

A FATTY liquid containing impurities is supplied to a rotating chamber by a pipe fitted with a valve which is controlled by the liquid when the latter reaches a predetermined level. The liquid is discharged from the chamber by its centrifugal force and is emulsified by passing it in a thin film at high velocity between closely adjacent surfaces. The impurities are retained against the inner wall of the rotating chamber.—W. F. F.

**Filtering-belt.** J. M. Callow, Assignor to The General Engineering Co., Salt Lake City, Utah. U.S. Pat. 1,201,021, Oct. 10, 1916. Date of appl., Mar. 4, 1916.

AN endless travelling filtering-belt passes over two pulleys, the free portions being horizontal. Liquid is filtered through the lower portion and the caked material withdrawn from the upper portion by suction nozzles arranged close to and below the belt.—W. F. F.

**Filter press.** C. Sellenscheidt, Assignor to Filter- und Brautechnische Maschinenfabrik A.-G. vorm. L. A. Enzinger, Berlin. U.S. Pat. 1,202,109, Oct. 24, 1916. Date of appl., May 22, 1915. Renewed Aug. 16, 1916.

A NUMBER of similar discs, having ribbed and grooved faces, a central aperture, and central and peripheral flanges, are arranged one above the other within a casing, with discs of filter material between them. The grooves on the opposite faces of each disc communicate alternately with the central aperture and with the periphery of the disc. The liquid to be filtered is forced into the casing under pressure, passes into the grooves which communicate with the periphery of the discs, then through the filter discs and through the grooves on the opposite face to the conduit formed by the central apertures in the discs.—W. H. C.

**Filters; Apparatus for the supply of compressed air, gas, steam, water under pressure, or the like to** ——. A. Neumann, Reppen. Ger. Pat. 294,312, Nov. 17, 1915.

COMPRESSED air, steam, or water under pressure is supplied to a filter-bed for cleaning purposes through a system of non-perforated pipes, of different lengths, each pipe being provided with a regulating valve, and with a nozzle at the end. The system of pipes is movable; for example, the pipes may project radially from a central hollow shaft, which can be rotated. The pressure of the air, steam, or water delivered through each pipe can be independently regulated, and by rotating the shaft, every part of the filter-bed is in turn brought under the influence of the cleansing medium.—A. S.

**Separator; Centrifugal** ——. N. J. Lloyd, Butte, Mont. U.S. Pat. 1,202,397, Oct. 24, 1916. Date of appl., Oct. 7, 1914.

THE bowl of the separator has a series of circumferentially spaced openings for the discharge of the contents and is provided with a screwed-on cover having a series of notches which register with the openings in the bowl.—W. H. C.

**Dryers.** B. S. Harrison, Manhattan, N.Y., U.S.A.  
Eng. Pat. 101,941, June 19, 1916. (Appl.  
No. 8632 of 1916.)

SEE U.S. Pat. 1,191,075 of 1916; this J., 1916, 881.

## II.—FUEL; GAS; MINERAL OILS AND WAXES.

**Coke-oven gases; The equivalent of the observed heat value of the light oil [benzol] scrubbed from —.** J. W. Shaeffer. American Gas Inst., Oct., 1916. J. Gas Lighting, 1916, 136, 397—398.

RESULTS of inquiries sent to thirty by-product coke plants throughout the United States showed that the loss in B.Th.U. of the gas due to scrubbing out the light oil is only slightly greater than the heat value of the light oil removed. The heating value of the light oil, determined by calorimeter tests, was found to be 17,400 B.Th.U. per lb., to which was added 167 B.Th.U., the latent heat of vaporisation of benzol, giving 17,567 B.Th.U. as the gross heating value per lb. of light oil vapour. The corresponding value for pure benzene is 18,793 B.Th.U. On this basis the theoretical loss in heating value averaged 4.45%, whilst the actual loss determined by calorimeter tests averaged 4.62%. For an efficient scrubbing plant these figures would reach 5.8%. The loss observed in using the gas, due to removal of light oil, is considerably greater than the loss determined by calorimeter, owing to the difference between the gross and the net heating values, and to improper adjustment of the air supply to the burners for the scrubbed gas. An analysis of coke-oven gas before and after scrubbing is given. The true value of light oil in a gas lies in its effectiveness per unit volume; 1.1% of light oil by volume furnishes 7.4% of the total heat developed by combustion of the gas.—J. E. C.

**Sulphur; Removal of — from spent oxide.** E. J. Murphy. American Gas Inst., Oct., 1916. J. Gas Lighting, 1916, 136, 396—397.

THE solubility of sulphur in various distillates (b.pt. from 150° to 200° C.) from water-gas tar was found to average 2.85 grms. per 100 c.c. at 20° C., the results being almost identical with those of Pelouze, who used coal-tar distillates. Extractions were also made on spent oxide, using a Gooch crucible in a Ford-Wiley-Soxhlet extractor. The results with various fractions showed that, on an average, 55.4% of the sulphur and tar was extracted, leaving 6.5% of sulphur in the extracted sample. Tests on the fouling properties of the extracted oxide, carried out on the Kueberger method, showed an absorption of hydrogen sulphide comparing favourably with that of any good oxide.—J. E. C.

### Gasoline standards.

THE U.S. Bureau of Mines has, at the request of the Federal Government of the District of Columbia, prepared tentative specifications for gasoline, which have been submitted for criticism to refiners, motor engineers, and others, with a view to issuing final specifications. The specific gravity test is not included in the specifications. The requirements laid down in the draft are that the gasoline and its combustion products should not have a strong or disagreeable odour; the gasoline should be free from water, sediment, acid, sulphur, etc., and should not contain an excessive percentage of unsaturated hydrocarbons, nor too high a percentage of highly volatile products which tend towards excessive evaporation losses and unnecessary danger in handling and storage. The

gasoline should not contain any considerable percentage of heavy or non-volatile constituents which prevent the atomisation into engine cylinders of a mixture that can be completely burnt. The limiting percentages of the constituents mentioned will be laid down in the final specifications.

**Paraffin base oils; Cracking of —.** The time factor and temperature factor under pressure. G. Egloff, T. Twomey, and R. J. Moore. Mot. and Chem. Eng., 1916, 15, 523—529. (See also this J., 1915, 1030; 1916, 411, 920, 1093.)

A GAS oil derived from Pennsylvania crude petroleum, yielding 95% distilling between 200° and 350° C., was cracked under a pressure of 150 lb. per sq. in. and at temperatures from 400° to 750° C., in a steel tube, 11.6 ft. long and 8 in. in diameter, through which the oil was passed at rates varying from 6 to 36 galls. per hour. Determinations were made of gasoline (to 150° C.), benzene, toluene, and xylene in the recovered oils, and also of unsaturated hydrocarbons in the gasoline and other fractions of the recovered oils. With an oil flow of 6 galls. per hr. the amounts of benzene, toluene, and xylene produced at 400° and 450° C. were 0.0 and 1.4, 1.5 and 3.1, and 1.6 and 3.2% by volume of the original oil, respectively. The maximum formation of these hydrocarbons collectively occurred at 750° C. and 36 galls. per hr. and amounted to 12.7%; the maxima for benzene, toluene, and xylene individually were 6.6, 4.5, and 3.4% at 650°, 750°, and 600° C. and 16, 36, and 16 galls. per hr. respectively. The maximum formation of gasoline—18.1% by volume of the original oil—occurred at 450° C. and 16 galls. per hr. and also at 500° C. and 30 galls. per hr. The percentage of unsaturated hydrocarbons in the gasoline fractions of the recovered oils ranged between 5.8 and 34.4.

—W. E. F. P.

**Reagents for use in gas analysis. Relative advantages of use of sodium and potassium hydroxides in the preparation of alkaline pyrogallol.** Anderson. See XXIII.

**Method of measuring the viscosity of very viscous substances.** Feild. See XXIII.

### PATENTS.

**Coal or the like: Apparatus for washing —.** The Grange Iron Co., Ltd., and H. P. Hoyle, Durham. Eng. Pats. 15,827, Nov. 9, 1915, and 6223, May 1, 1916.

IN an apparatus for washing coal, a reciprocating piston or an oscillating paddle with valves closing during the forward stroke and opening during the reverse stroke, is combined with a fixed, inclined mesh-plate or screen, the whole being arranged in a tank containing water. The piston or paddle is placed at an angle beneath the upper end of the screen, so that the agitation is progressively reduced towards the lower end. The coal is delivered from the screen over an adjustable weir, whilst the dirt falls into a pocket with a door balanced so as to discharge on reaching a certain weight.—J. E. C.

**Coal-washing apparatus.** E. G. Burks and N. Hayes, Birmingham, Ala. U.S. Pat. 1,201,143, Oct. 10, 1916. Date of appl., Aug. 16, 1915.

A SERIES of overflow tanks is combined with jiggling apparatus, fine coal passing to one tank and large coal to another. The overflow water from the fine coal tank is filtered through the large coal and the clear water is returned to the jiggling apparatus, whilst unfiltered dirty water from the fine coal tank is returned to the "bone coal" elevator tank.—J. E. C.

**Fuel blocks.** H. H. Kelsey and A. C. B. Webb, London. Eng. Pat. 15,230, Oct. 28, 1915.

FUEL blocks suitable for camp stoves are composed of plaster of Paris 112 lb., paraffin wax or vegetable oils or fats 37 lb., with or without sugar 14 lb., and a suitable dye in crude glycerin as a vehicle. The mixture is melted, rolled into grooved slabs, and broken into blocks. The blocks may be ignited by attached celluloid strips, or waxed cotton, wick fabrics, or match-head composition.—W. F. F.

**Spent tar bark, peat, and the like; Treatment of — for use as fuel.** J. Mackenzie, Middlesbrough, Eng. Pat. 101,730, Jan. 15, 1916. (Appl. No. 680 of 1916.)

SPENT bark is compressed to remove moisture, mixed with coal tar pitch, with or without the addition of peat, sawdust, coal or coke dust, heated, and compressed into briquettes.—J. E. C.

**Fuel; Composition —.** E. H. Smirk, Lytham, Lancs. Eng. Pat. 101,813, Jan. 26, 1916. (Appl. No. 1215 of 1916.)

BREWERS' barm or yeast is mixed with coal or coke dust, small coal or coke, or other suitable pulverised carbonaceous material, and water to form a paste which is moulded into briquettes. Sawdust, peat dust, tanners' spent waste, dyers' waste, coffee husks, or spent hops may also be added. (See also Eng. Pat. 14,990 of 1915.) —W. F. F.

**Powdered coal and analogous fuel; Process of burning —.** E. P. Roberts, Cleveland, Ohio. U.S. Pat. 1,200,028, Oct. 3, 1916. Date of appl., Dec. 10, 1915.

COAL dust, gas, or oil and an insufficient supply of air are admitted at one end of a combustion chamber and ignited. Subsidiary streams of gas and secondary air are admitted so as to deflect the main stream, compelling it to follow a sinuous path between the inlet and outlet. The secondary air completes the combustion.—J. E. C.

**Heating [coke-oven walls and the like]; Art of —.** A. Roberts, Evanston, Ill. U.S. Pat. 1,200,871, Oct. 10, 1916. Date of appl., Aug. 5, 1915.

IN a coke-oven wall or the like, the gases are caused to impinge repeatedly and violently against portions of the wall as they pass from inlet to outlet. The amount of impingement increases towards the outlet, giving an increased heat transfer, compensating for decreased temperature of gases, and securing uniform heating effect. —J. E. C.

**Gas; Apparatus for manufacture of —.** C. B. Tully, Westminster. Eng. Pat. 101,815, Jan. 27, 1916. (Appl. No. 1318 of 1916.)

IN a plant manufacturing coal-gas and water-gas by separate independent means but withdrawing the products from both by a common exhauster, the water-gas element consists of generators operated in cyclic fashion, so as to supply an uninterrupted stream of water-gas. The steam, air, and snift valves are controlled by levers operated by a cam shaft driven through reduction gear by the steam engine operating the blower, in such a manner that two generators are always delivering water-gas whilst the third is being blown.—J. E. C.

**Gas rich in carbon monoxide; Method of making —.** H. Foersterling, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,200,719, Oct. 10, 1916. Date of appl., Nov. 9, 1912.

CARBON dioxide, steam, and air are passed through body of incandescent coke, producing a gas

rich in carbon monoxide. This gas is cooled, by using it to generate steam, and is then burnt. Carbon dioxide is separated from the products of combustion by a liquid absorbent, which on further heating liberates the carbon dioxide. The carbon dioxide, thus liberated, along with a portion of the steam produced, and air, is admitted into a mass of incandescent coke.—J. E. C.

**Gas-producer.** W. J. Lay, Melville, Saskatchewan, Canada. U.S. Pat. 1,200,857, Oct. 10, 1916. Date of appl., July 10, 1915.

IN a gas producer, a water jacket is combined with an air-inlet casting; the water surrounds air-inlet pipes which communicate with the exterior air and the space above the water in the jacket.—J. E. C.

**Gas; Process and apparatus for removing tar and other condensables from —.** W. C. Dayton, Assignor to G. H. Smith, Buffalo, N.Y. U.S. Pat. 1,200,442, Oct. 3, 1916. Date of appl., Feb. 5, 1914.

GAS is expanded under partial vacuum in a cylinder, then compressed to a predetermined degree, and discharged through a narrow slit, of such dimensions as to agglomerate the tar particles, into an expansion chamber in which separation of gas and liquid takes place.—J. E. C.

**Ammonia; Process for returning condensed — to distillation gases.** K. Burkheiser, Dortmund. Ger. Pat. 294,130, Feb. 25, 1916.

THE ammoniacal liquor is distilled, and the concentrated liquor thus obtained is brought in contact with the hot crude gas before the latter is treated for the recovery of ammonia by the direct or semi-direct process.—A. S.

**Petroleum oils; Process and apparatus for converting heavy — into light oils.** M. J. Trumble, Los Angeles, Cal., U.S.A. Eng. Pat. 15,084, Oct. 25, 1915.

PETROLEUM oil is forced through a coil (heated to a sufficient degree to crack the oil), at such velocity and pressure as to convert the oil into a foam. The foam passes into a chamber in which the lighter vapours separate and are conducted to dephlegmating and condensing plant. The heavier products are collected and returned to the heating coil, thus forming a closed ring, the volume being maintained by the addition of fresh oil equivalent to the volume of light products condensed and removed.—J. E. C.

**Petroleum; Process of and apparatus for distilling —.** A. S. Hopkins, Assignor to The Standard Oil Co., Neodesha, Kans. U.S. Pats. (A) 1,199,463 and (B) 1,199,464, Sept. 20, 1916. Date of appl., Dec. 18, 1915.

(A) PETROLEUM hydrocarbons, having boiling points above 500° F. (260° C.), are distilled from 650° to 850° F. (340° to 450° C.), and under a pressure of upwards of four atmospheres. The mixed vapours are led from the still to a reflux fractionating surface condenser in free communication with the still, the surfaces of the condenser being cooled by a regulated quantity of fresh stock of the petroleum, so that the latter is heated and a constant temperature maintained in the vapour. The heated stock is mixed with the distillate formed in the reflux condenser, and the mixture led to the still through the vapour outlet pipe. The vapours passing the condenser are carried off and separately condensed and collected. (B) The apparatus is composed of a still, an inclined dephlegmator leading in an upward direction from it, and a vertical cylindrical condenser shell acting as a reflux fractionating surface condenser, the lower end of the latter being in communication with the upper end of the de-

phlegmator so as to receive vapours therefrom and discharge condensed liquid into it. The shell is subdivided by internal partitions into upper and lower vapour compartments and intermediate condensing passages. Cold liquid is fed to the outer walls of the condensing passages, the feed being controlled by a valve and a thermostat, located in the upper vapour compartment, the thermostat operating means for regulating the valve. The cooling liquid is led through a transfer circuit to the upper end of the dephlegmator after it has traversed the condenser, and means are provided for carrying off and separately condensing the vapours leaving the upper vapour compartment. —B. N.

*Refining method and apparatus [for gasoline].* A. N. Kerr, Tulsa, Okla. U.S. Pat. 1,199,903, Oct. 3, 1916. Date of appl., Feb. 19, 1916.

CASING head gasoline is distilled in a steam still under moderate pressure, and the distillation product is settled and cooled, the light volatile fractions being run off, down to approximately 96° B. (sp.gr. 0.62) in a finely divided form and absorbed in a low grade product, such as naphtha or the like, so as to enrich the latter. The product, from approximately 96 to 72° B. (sp.gr. 0.62—0.69), is run into a container, and the heavier distillate is graded in tanks at predetermined gravities.—B. N.

*Motor spirit [from petroleum]; Process for producing a new —.* W. Landes, Wichita, Kans. U.S. Pat. 1,199,909, Oct. 3, 1916. Date of appl., Feb. 9, 1915.

Crude petroleum is forced from a tank, or tanks, through a nozzle, and is discharged in a minute stream into a casing co-axial with the nozzle. Steam is injected into the casing for preheating and initially expanding the oil while in the nozzle, the steam subsequently cutting through the stream of oil transversely to its path, thus again expanding the oil and dissipating the particles. The oil issues from the casing in an exceedingly fine mist into one end of an expansion chamber heated to approximately 180° F. (82° C.), thus further expanding the mist and causing instantaneous vaporisation of the highly combustible and volatile constituents of the petroleum. The homogeneous gas, thus produced, is allowed to travel slowly through the heated expansion chamber, to separate the heavier and more bituminous components, and the gas is conducted to a primary condenser, within which it is sprayed with a condensing medium. The gas is finally passed to a secondary condenser, and the resulting fluid, forming a highly combustible and volatile homogeneous fluid of low specific gravity, is conducted to a receiver. —B. N.

*Cool gas; Method and apparatus for manufacturing —.* A. E. White, London. From Riter-Conley Manufacturing Co., Leedsdale, Pa., U.S.A. Eng. Pat. 16,891, Dec. 1, 1915.

SEE U.S. Pats. 1,167,149 and 1,167,150 of 1916; this J., 1916, 245.

*Gas producers.* P. A. J. Cousin, Loos-lez-Lille, France. Eng. Pat. 28,446, Dec. 9, 1913. Under Int. Conv., Dec. 9, 1912.

SEE Addition of Dec. 9, 1912, to Fr. Pat. 435,532 of 1911; this J., 1913, 647.

*Recovery of aluminium chloride [from oil-containing residues].* U.S. Pat. 1,202,081. See VII.

*Manufacture of a binding medium for tar-macadam roads.* Ger. Pat. 294,481. See IX.

## IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

*Light; Limits of the production of — by radiation: the so-called mechanical equivalent of light, and electric incandescence lamps.* A. Meyer, Beleuchtungs-techn. Ges., Sept. 1916. Z. angew. Chem., 1916, 29, Wirtschaftl. Teil, 618—619.

THE author endeavours to find a relationship between the illuminating power of a radiant body similar to Stefan's law connecting the radiation of heat and temperature of a black body. The number of watts required to produce a luminosity of 1 spherical candle power (12.57 lumens) from a black body at various temperatures with an efficiency of 0.4—0.75 may be calculated. The minimum amount of power required is 0.0403 watt at 5300° abs. It is also possible to determine the efficiency of an illuminant if the temperature of a black body at which the latter exhibits the same energy distribution as the illuminant is known. The temperature of the filament in commercial electric lamps is not economical; a much greater efficiency is obtained at 4000° abs., but there is no advantage in a temperature above 6000° abs. Carbon has a greater efficiency than a truly black body, and lamps with a metallic filament *in vacuo* are far superior to carbon filament lamps. Metallic filament lamps filled with inert gas are less efficient than the corresponding vacuum lamps, but have the advantage that they may be operated with the filament at a higher temperature. The author has calculated the percentage of the energy applied to the lamp which is emitted in the form of optically useful light in lamps under normal conditions as follows:—Carbon filament, 0.35%; tantalum, 0.70%; tungsten, 1.05%; "half-watt" lamp, 2.55%. These figures are better than those for a black body, but are far removed from the efficiencies theoretically possible.—A. B. S.

*Flame arc in chemical manufacture.* W. R. Mott and C. W. Bedford. J. Ind. Eng. Chem., 1916, 8, 1029—1035.

A FLAME arc operated at high amperage is, in proportion to power taken, the most efficient known light source for photochemical reactions such as the chlorination of hydrocarbons. The white flame arc is already extensively used in photo-engraving, blue-printing, and other photographic work, and has recently been applied to the testing of dyes for fastness (see this J., 1915, 1084). A single flame arc can be made ten to twenty times more powerful as to photochemical effect than any other single lamp except the high amperage enclosed arc, and is three times more powerful than the latter at the same amperage. The white flame arc is more powerful than flame arcs of other colours for many purposes and is better suited for use with vessels of ordinary glass, which transmits nearly the whole of its active rays. The light of the white flame arc extends very little into the far ultra-violet (beyond 3000 Å) and is very similar to sunlight plus blue skylight. Its photographic effect on "solio" paper, within the limits of moderate arc voltages (40—80), can be expressed approximately by the expression,  $KC^2(V-23)$ , where  $C$  is the current (continuous) in amperes,  $V$  is the arc voltage, and  $K$  is a constant, having the value 0.0085, with an average deviation of  $\pm 0.0009$ ; the standard of reference (100) is the photographic effect of a 110-volt continuous current flame arc lamp operating at 25 amperes and 65 arc volts. A high-amperage enclosed arc lamp may be adapted for use with flame carbons, part of the current being shunted around the usual lamp resistance and solenoid and through a resistance capable of carrying 15—20 amperes at 55 volts without deterioration; in a similar arrangement

for alternating current a reactance coil is inserted in the shunt circuit instead of the resistance. The white flame arc has been used successfully in connection with the chlorination of natural gas for the manufacture of chloroform.—A. S.

#### PATENTS.

*Charcoal; Preparation of vegetable*——. A. H. Bonnard, London, T. E. Rule and J. Nicol, Liverpool. Eng. Pat. 10,622, July 21, 1915.

VEGETABLE charcoal is prepared by heating a carbonaceous material of vegetable origin in the presence of a carbonate or oxide of an alkaline earth metal, e.g., calcium, to a bright red heat (about 1000° C.). At least 30% of chalk should be used, and after heating, the material is washed with hydrochloric acid until free from lime, and finally with water to free it from acid.—J. E. C.

*Retort.* J. L. Graffin and H. M. Chase, Wilmington, N.C. U.S. Pat. 1,200,606, Oct. 10, 1916. Date of appl., Aug. 5, 1913.

A RETORT for dry distillation is fitted with a vapour outlet having an upwardly opening mouth near the bottom of the retort and a vapour outlet with a downwardly opening mouth at the top.—J. E. C.

*Retort or still.* H. MacRae and H. M. Chase, Wilmington, N.C. U.S. Pat. 1,200,634, Oct. 10, 1916. Date of appl., June 23, 1914.

A SERIES of concentric heating coils is arranged within a retort, with spaces between them to receive a non-liquid material for distillation. The innermost coil surrounds a passage open at both ends and through which a current of gas is circulated towards the end opposite to the off-take.—J. E. C.

*Retort carbon; Method for producing pure*——. E. Szavasy, Budapest, Austria-Hungary. U.S. Pat. 1,199,220, Sept. 26, 1916. Date of appl., Feb. 12, 1915.

METHANE is decomposed by passing it over fragments of carbon heated to a glowing condition. The fragments are kept moving and are removed after increasing in size, being replaced by a quantity of fragments of smaller size.—J. E. C.

*Retort; Revolvable*——. W. Thomas, Nanaimo, B.C., Canada. U.S. Pat. 1,201,531, Oct. 17, 1916. Date of appl., June 4, 1915.

SEE Eng. Pat. 9156 of 1915; this J., 1916, 827.

*Metallic filaments for incandescence electric lamps and for other purposes; Process for manufacturing*——. K. Nishimoto, Tokyo, Japan. U.S. Pat. 1,201,611, Oct. 17, 1916. Date of appl., May 21, 1915.

SEE Eng. Pat. 7829 of 1915; this J., 1916, 731.

*Art of heating [coke-oven walls and the like].* U.S. Pat. 1,200,871. See IIA.

### III.—TAR AND TAR PRODUCTS.

*Benzene; Conditions for the formation of explosive mixtures of*——with air. Martini und Hüneke. Chem.-Zeit., 1916, 40, 948—949.

CONTRARY to a common belief, mixtures of benzene vapour with air explode within wider limits than mixtures of petroleum spirit with air. In the case of petroleum spirit, mixtures containing from 2.4 to 4.6% were explosive, whilst for mixtures of benzene vapour with air the limits of explosibility were from 2.7 to 6.5%. Determinations of the partial pressures of the vapours at different tem-

peratures showed that to be reasonably certain of avoiding the risk of explosion with benzene vapour by exceeding the upper limit of explosibility in the air in the benzol store, temperatures of at least 30° C. are necessary. Owing to its greater volatility petroleum spirit frequently forms mixtures at ordinary temperatures, which exceed the upper limit, and are therefore not explosive. Impure benzene left on the interior of cans evaporates very slowly, and in spite of careful blowing with air or steam, and exposure of the open can to the air for several days may still remain in sufficient quantity to form explosive mixtures with air.—C. A. M.

*Naphthols; Discrimination between the two*——by the titanil sulphate reagent. G. Denigès. Ann. Chim. Analyt., 1916, 21, 216—217.

AN intense green coloration is produced when  $\alpha$ -naphthol (not more than 0.01—0.02 gm.) is shaken with 2—3 c.c. of the reagent suggested for certain alkaloids (see page 1234) but  $\beta$ -naphthol gives a blood-red colour under similar conditions; on diluting the liquids with acetic acid the colour given by  $\alpha$ -naphthol becomes reddish-violet whilst that given by  $\beta$ -naphthol remains unchanged. If the naphthol is first dissolved in 10—20 drops of acetic acid, and 2—3 c.c. of the reagent is carefully added, to form a lower layer, a green ring surmounted by a reddish-violet layer is formed in the case of  $\alpha$ -naphthol, and a blood-red ring in the case of  $\beta$ -naphthol. Naphthol esters behave like the free naphthols if they are warmed slightly with the reagent.—J. H. L.

*Method of measuring the viscosity of very viscous substances.* Feild. See XXIII.

#### PATENTS.

*Phenol; Manufacture of*——. D. Tyrer, Stockton-on-Tees. Eng. Pat. 101,807, Jan. 12, 1916. (Appl. No. 522 of 1916.)

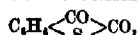
A METHOD of obtaining sodium benzenesulphonate from the mixture of benzenesulphonic acid and sulphuric acid resulting from the sulphonation of benzene, consists in adding a quantity of a base forming an insoluble sulphate, sufficient to convert the acids into sulphonate and sulphate respectively, and to neutralise a quantity of nitre cake equivalent to the sulphonic acid, and then adding the above quantity of nitre cake. The quantities of base and nitre cake may be adjusted so as to produce *in situ* some of the caustic soda required for subsequent conversion of sodium benzenesulphonate into sodium phenoxide. For example, 100 parts of the sulphonation product, containing 85% of sulphonic acid, is treated with 2000 parts of a solution containing 244 parts of sodium bisulphate and 100 parts of finely powdered quicklime. The solution is filtered, treated with 145 parts of barium hydroxide, and again filtered. The resulting solution contains sodium benzenesulphonate and sufficient caustic soda to convert it into phenol. The solution is evaporated and the product fused.—J. E. C.

*Benzyl chloride from toluene; Process of making*——. C. Ellis, Montclair, N.J., Assignor to Chadeloid Chemical Co., New York. U.S. Pat. 1,202,040, Oct. 24, 1916. Date of appl., Aug. 16, 1912.

A MIXTURE of toluene vapour with sufficient chlorine to combine with 25—50% of the toluene is passed through a heated zone where it is subjected to a gradually increasing temperature above the boiling-point of toluene, the benzyl chloride is condensed, and the toluene afterwards condensed is freed from hydrogen chloride and again used in the process.—F. W. A.

**2,3-Diketodihydrothionaphthenes; Manufacture of** — R. Stollé, Heidelberg. Ger. Pat. 281,759, Jan. 17, 1914. Addition to Ger. Pat. 281,046.

**2,3-DIKETODIHYDROTHIONAPHTHENES,**



are obtained by treating aromatic mercaptans with oxalyl chloride, and subjecting the resulting chlorides of formula,  $\text{R.S.CO.CO.Cl}$ , to the action of condensing agents. Methyl-2,3-diketodihydrothionaphthene, glistening yellowish-red leaflets, m.pt.  $144^\circ\text{C}$ ., is obtained in this way from *p*-thiocresol.—A. S.

**3-Nitro-1-aminobenzene-6-sulphonic acid; Manufacture of** — Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 294,547, Feb. 6, 1915.

*m*-NITROANILINE is sulphonated at  $120^\circ\text{--}140^\circ\text{C}$ . with the calculated quantity or a slight excess of fuming sulphuric acid, and the product is cooled and stirred with water. The sulphonic acid separates, and is filtered off and washed. It may be purified by means of its sparingly soluble sodium salt.—A. S.

**Tar distillates; Method of producing pure** — M. Melamid, Freiburg, Germany. U.S. Pat. 1,201,601, Oct. 17, 1916. Date of appl. June 10, 1913.

SEE Addition of Sept. 30, 1912, to Fr. Pat. 443,650 of 1912; this J., 1913, 415.

**Manufacture of a binding medium for tar-macadam roads.** Ger. Pat. 204,481. See IX.

#### IV.—COLOURING MATTERS AND DYES.

**Indigo; Rapid volumetric determination of** — S. M. Jones and W. Spaans. J. Ind. Eng. Chem., 1916, 8, 1001—1002.

THE method consists in titrating the disulphonic acid of indigo with a solution of sodium formaldehyde-sulphoxylate in an atmosphere of hydrogen, the reduction of the indigo being accelerated by addition of sodium bisulphite, the effect of which is to liberate sodium sulphonylate from the formaldehyde-compound. One gram of indigo powder (or 2 grms. of 50% paste or 5 grms. of 20% paste) is sulphonated with 15 c.c. of sulphuric acid of sp.gr. 1.84 (2—4 hours at  $55^\circ\text{--}60^\circ\text{C}$ .), and after cooling, the sulphonated product is diluted to 1 litre with water, filtered, and 50 c.c. of the solution and 50 c.c. of a 35% solution of sodium bisulphite are placed in a 300 c.c. Erlenmeyer flask closed by a stopper carrying a thermometer, the stem of a burette, and an inlet and outlet tube for hydrogen. The solution is heated to  $75^\circ\text{C}$ ., a vigorous current of hydrogen is passed through, and the indigosulphonic acid titrated with a solution of 1 gram of sodium formaldehyde-sulphoxylate (Rongalite C) in 1 litre of water. The amount of sulphonylate required is first determined approximately by a rapid preliminary titration. The formaldehyde-sulphoxylate solution is standardised by a determination carried out in exactly the same way with 1 gram of C.P. indigo. (Compare Bloxam, this J., 1906, 735.) —A. S.

**Anthocyanins; Investigation of the** — Parts XI.—XVIII. R. Willstätter and others. Annalen, 1916, 412, 113—251. (See this J., 1916, 300.)

THE anthocyanins constituting the colouring matter of a further series of flowers and fruits have been investigated, and in confirmation of deductions drawn from previous work, it appears that in spite of the multiplicity of anthocyanins, the anthocyanidins or sugar-free colouring matters which they yield are few in number, in fact all the

anthocyanins examined proved to be glucosides of pelargonidin, cyanidin, or delphinidin or their methyl ethers, differing in the nature, the number, and mode of combination of the sugar residues. From *Salvia* sp. the anthocyanin salvianin was isolated, which on hydrolysis gave 2 mols. of dextrose, malonic acid, and pelargonidin. As intermediate products the normal diglucoside salvinin (chloride,  $\text{C}_{27}\text{H}_{41}\text{O}_{11}\text{Cl}$ ), and a beautifully crystallising compound salvin, containing apparently 2 mols.  $\text{H}_2\text{O}$  less than salvinin, were isolated. The formation of a monoglucoside was also detected, but it was not identical with pelargonenin, the monoglucoside isolated as an intermediate product of the hydrolysis of pelargonin to the sugar-free pelargonidin. From the chrysanthemum a new monoglucoside of cyanidin, chrysanthemin, was isolated. It gave a Bordeaux red crystalline chloride,  $\text{C}_{27}\text{H}_{41}\text{O}_{11}\text{Cl}$ . From the aster an isomeric but not identical monoglucoside of cyanidin was obtained to which the name asterin was given. Its chloride formed bronze brown prisms, differing in solubility and other particulars from chrysanthemin. A second monoglucoside, callistephin, was also isolated from the colouring matter of the aster. This substance proved to be a derivative of pelargonidin, but was not identical with the above-mentioned pelargonenin. The glucosides of cyanidin are widely distributed among the fruits, and were found in berries differing in colour from yellowish-red to deep blue. The investigation of the anthocyanins of the fruit of two species of *Prunus*, the cherry and the sloe, revealed the presence of two different diglucosides of cyanidin, keracyanin and prunicyanin respectively. The former bears a close resemblance to cyanin, whilst the latter has a similar relationship to meocyanin, the anthocyanin of poppy petals. Both the fruit anthocyanins however are characterised as rhamnoglucosides, as distinct from the petal anthocyanins in which both sugar groups are dextrose residues. Apart from the rhamnose content, prunicyanin is probably quite similarly constituted to meocyanin, which it resembles in solubility and reaction much more closely than keracyanin with which it is isomeric. Hitherto only one anthocyanin of delphinidin itself, viz., delphinin, had been isolated. A second, violanin, has now been obtained from the petals of the violet pansy, *Viola tricolor*, which are characterised by an unusually high content of colouring matter, amounting to one-third of the weight of the dried substance. On hydrolysis violanin gave rhamnose, dextrose, and delphinidin, and the opportunity was taken to study more closely the properties and characteristics of the latter, the chloride of which was shown to form four distinct hydrates of completely different crystalline habits. The anthocyanin of the cultivated petunia, *P. hybrida hort.*, is the diglucoside of a monomethyl delphinidin, to which the name petunidin is given. The anthocyanin, petunin, isolated as its chloride,  $\text{C}_{27}\text{H}_{43}\text{O}_{17}\text{Cl}$ , forms bronze glittering crystals, violet by transmitted light. Petunidin closely resembles its isomeride myrtillidin in giving an intense blue colour with ferric chloride, and phloroglucinol and a methylated acid on hydrolysis with sodium hydroxide. It differed from the latter in colour and solubility. Myrtillin, the monogalactoside of myrtillidin, was isolated from the bilberry, as bronze brown crystals of the chloride, having a greenish metallic glance. The colouring matter of the grape, cenin, which was previously described, and which was identified as the monoglucoside of a dimethyl delphinidin, is now shown to be accompanied by small quantities of the diglucoside and the free anthocyanin on the one hand, and by a monoglucoside of monomethyl delphinidin, which was actually isolated in a fairly pure condition from a closely related species, *Ampelopsis quinquefolia*, and is

termed ampelopsin. A third anthocyanin of the vine species was isolated from *Vitis riparia*. All three anthocyanins give bluish-red colours in alcohol; they differ in reaction with alcoholic ferric chloride according to the positions of the unmethylated delphinidin hydroxyl groups.

—G. F. M.

#### PATENTS.

[Azo] wool dyestuff; Red —. W. Bergdolt, Leverkusen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,201,544, Oct. 17, 1916. Date of appl., Mar. 27, 1915; renewed Sept. 6, 1916.

New azo dyestuffs are claimed which dye wool yellowish-red to red shades fast to light and which give on reduction with zinc powder, and acetic acid an acidylated *m*-phenylenediamine-sulphonic acid and 1,2-diamino-8-naphthol-6-sulphonic acid. —F. W. A.

Vat colouring matters and process of making them. M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,201,968, Oct. 17, 1916. Date of appl., Feb. 11, 1914.

THE colouring matters obtained by heating an oxidised dibenzanthrone to a temperature above 100° C. in absence of an oxidising agent are brominated. The products yield blue vats with hydrosulphite and dye cotton green. —F. W. A.

Vat dyestuffs and process of making them. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,202,260, Oct. 24, 1916. Date of appl., Oct. 21, 1914.

AN aminodibenzanthrone is treated with a substance capable of introducing a halogenated organic radical into the amino-group, e.g., with *o*-chlorobenzaldehyde. The products dye cotton from a hydrosulphite vat red to claret shades.

—F. W. A.

Diarylidbenzoquinones; Preparation of —. Farb. vorm. Meister, Lucius, u. Brüning. Ger. Pat. 292,176, May 28, 1914.

UNSYMMETRICAL diarylidbenzoquinones or diarylidchlorbenzoquinones, of value as vat dyestuffs, are prepared by the interaction of 2-amino-5-arylidbenzoquinones or 2-amino-5-arylidchlorbenzoquinones with aromatic amines.

—A. S.

Anthraquinone series; Manufacture of condensation products [dyestuffs] of the —. L. Durand, Huguenin, und Co. Ger. Pat. 294,447, May 26, 1913.

CORULEIN or the dyestuffs described in Ger. Pat. 257,084 are condensed with aromatic amino-compounds either directly or in presence of a solvent, and with or without moderate heating (e.g., to 90°–100° C.). The resulting condensation products may be sulphonated or converted into salts. They are greener in shade than the original dyestuffs. The dyestuffs described in Fr. Pat. 458,681 do not behave in a similar manner, and it appears probable that only compounds of which the molecules comprise a quinonoid nucleus containing hydroxyl groups are capable of condensing with amines. —A. S.

#### V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Paper; Method for determining the strength of — when wet. E. O. Reed. J. Ind. Eng. Chem., 1916, 8, 1003–1004.

STRIPS of the paper 15 mm. in width and of

sufficient length to allow of a breaking length of 100 mm. in the testing machine, are immersed in water at 70° F. (21° C.) for exactly 20 min., and then immediately tested in a Schopper machine calibrated to read from 1 to 1000 grms. Strips cut from the sheet both in a longitudinal and in a transverse direction are tested. The results are markedly affected by variations in the temperature of the water and the time of immersion. Tables of results are given. There is no direct relationship between the dry strength and the wet strength of paper. To obtain high wet strength the paper should be made from long-fibre pulp beaten "wet" and well matted, and sized so as to render the fibres water-resistant. The test has proved of value for controlling the quality of blue and brown print paper, and should be useful also for determining the serviceability of other photographic papers, wrapping papers, paper textiles, paper used for bags for cement, lime, etc., and paper which is to be printed while wet. (See also Beadle and Stevens, this J., 1914, 639.) —A. S.

Sulphite-cellulose; Volatile organic compounds, especially essential oils, formed in the manufacture of —. Z. Kertész. Chem.-Zeit., 1916, 40, 945–948.

THE residual liquors from the manufacture of sulphite-cellulose were prepared for fermentation by the following methods: 10 litres was mixed (1) with powdered chalk and aerated for 1 hour; (2) with 5 grms. of ammonium sulphate and aerated for 2 hours; (3) with 1 gm. of manganese sulphate and aerated for 3 hours. After neutralisation (in the case of 2 and 3) the liquids were filtered, mixed with 10 grms. of yeast, and fermented for 5 days, with frequent shaking, at 20° to 25° C. On the sixth day they were made slightly alkaline with lime and distilled. The following yields of alcohol (including methyl alcohol, acetone, and acetaldehyde) per litre were obtained:—(1) 8.94 c.c.; (2) 8.74 c.c.; (3) 8.68 c.c. By distilling the first sample in a column still without previous neutralisation, the resulting "sulphite spirit" contained formic and acetic acids and acetates, whilst sulphur (reduced from the sulphur dioxide by acetaldehyde and formic acid) separated in the still. The presence of these reducing substances may also cause a loss of sulphur dioxide during the boiling of the cellulose. On diluting sulphite spirit with water an emulsion is formed. With sulphuric acid it gives a red coloration (cymene, terpenes), and it shows the furfural reaction with aniline and acetic anhydride. From 1000 litres of liquid (obtained from the treatment of 100 kilos. of air-dried cellulose) the following constituents were separated:—Acetaldehyde, 0.06 kilo.; acetone, 0.20 kilo.; methyl alcohol, 0.53 kilo.; and alcohol, 6.32 kilos. The cymene and the terpenes are insoluble in water, while the furfural dissolves in the proportion of 11:100 at 13° C. This solubility of furfural accounts for the fact that the crude oil which collects on the surface of the liquid in the mixing reservoir is free from furfural, while the oil obtained in the manufacture of sulphite spirit contains it. A sesquiterpene,  $C_{15}H_{24}$ , boiling at 250° to 260° C. and having a sp.gr. of 0.925 at 21° C., and a diterpene,  $C_{20}H_{32}$ , boiling above 300° C. and with sp.gr. 0.950 at 21° C., were isolated. —C. A. M.

#### PATENTS.

Straw, fuscine and other materials; Process and apparatus for manufacturing compressed fabric [e.g., mats] from —. N. Gekoulin, Moscow. Eng. Pat. 101,741, Jan. 27, 1916. (Appl. No. 1336 of 1916.)

STRAW, rushes, etc., arranged in transverse bundles, are successively fed on a feed table to a

vertically expanding box between two vertical walls of iron wires, where the material is compressed in two operations and subsequently mechanically hooked in a compressed state by means of hooks tightening opposite wires. The material may be mixed with cement, lime, or similar binding material before treatment, or the matting may be sprinkled with alkali silicate solution, compressed, and immersed in a solution of aluminium sulphate or lime.—J. F. B.

*Acetylcellulose plastic composition; Process of making*—W. G. Lindsay, Caldwell, N.J., Assignor to The Celluloid Co., New York. U.S. Pat. 1,199,395, Sept. 26, 1916. Date of appl., July 10, 1915.

ACETONE-SOLUBLE acetylcellulose is treated with a mixture of water, benzene, and methyl alcohol, and is allowed to stand at the ordinary temperature until it has gelatinised. *p*-Ethyltoluenesulphonamide and triphenyl phosphate are added, and the mixture is kneaded, heated, and pressed.—F. Sp.

*Non-inflammable cellulose compound*. W. G. Lindsay, Caldwell, N.J., Assignor to The Celluloid Co. U.S. Pat. 1,199,798, Oct. 3, 1916. Date of appl., Sept. 10, 1912.

ACETYLCELLULOSE and diphenylamine are dissolved in acetone, and the solution is allowed to dry and harden by evaporation.—F. Sp.

*Acetylcellulose; Compound of—and process of making same*. W. G. Lindsay, Newark, N.J., Assignor to The Celluloid Co. U.S. Pat. 1,199,799, Oct. 3, 1916. Date of appl., Jan. 29, 1914.

A MIXTURE is claimed containing, *e.g.*, 100 pts. of acetylcellulose, 10 to 40 pts. of triphenylphosphate, and from 5–30 pts. of a liquid mono-hydroxy aliphatic alcohol containing more than two carbon atoms.—F. Sp.

*Plastic composition [from acetylcellulose] and process [for making same]*. W. G. Lindsay, Newark, N.J., Assignor to The Celluloid Co. U.S. Pat. 1,199,800, Oct. 3, 1916. Date of appl., Dec. 12, 1914.

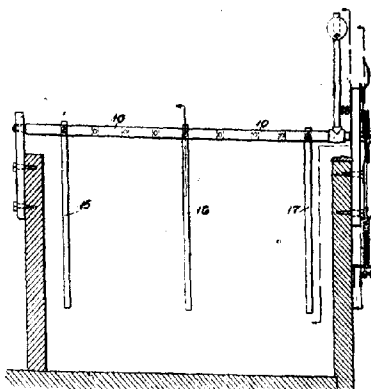
A PLASTIC composition is made by drying a solution of acetone-soluble acetylcellulose, a solid substance, and a liquid of high boiling point, *e.g.*, fusel oil, in a mixture of a chlorinated hydrocarbon, *e.g.*, chloroform, and alcohol.—F. Sp.

*Cardboard or pasteboard; Impermeable—and process of manufacture*. M. Serebrianyj, Moscow. Eng. Pat. 10,599, July 21, 1915.

AN impermeable board is prepared from boiled and ground wood-pulp impregnated in the beater with 8.5 kilos. of "resinous glue" (extract from fir-wood) and 7 kilos. of rosin per 150 of wood-pulp. The resinous constituents are dissolved in alcohol, ether, or benzene in the form of a 20% solution before mixing with the pulp. Alternatively the pulp to be impregnated may be composed of about equal parts of rag-fibre, largely flax, and old document papers, and treated with 7 kilos. of "resinous glue," dissolved in a suitable solvent, per 150 kilos. of pulp. According to the degree of impermeability required, the proportions of impregnating materials may be varied from 4.5 to 70 kilos.—J. F. B.

*Viscosity of paper stock; Mechanism for determining the—*. S. W. Webb, Winchester, Mass. U.S. Pat. 1,201,402, Oct. 17, 1916. Date of appl., Dec. 16, 1915.

AN apparatus for measuring the viscosity or density of paper stock during a beating operation consists of a beater tub with a beater to cause a continuous flow of the paper stock through the tub, a rock shaft, 10, arranged across the stream



of stock and carrying drags, 15, 16, 17, 18, an index on the shaft movable along a graduated scale, a wheel, 28, on the shaft, and a spring, 24, fixed at one end and attached at the other end to a flexible member secured to and tracking on the wheel.—F. W. A.

*Paper; Resinous emulsion for sizing*—W. P. Thompson, Liverpool. From R. Lender, Neubabelsberg, Germany. Eng. Pat. 17,576, Dec. 16, 1915.

COUMARONE and indene, occurring in the fractions of coal tar distillates boiling at 160°–185° C., are polymerised to resins by treatment with sulphuric acid. Five to ten parts of coumarone or indene resin is melted with one part of a natural saponifiable resin, oil, or fat until frothing ceases, and the mixture is emulsified by means of alkali, ammonia, or sodium silicate.—J. F. B.

*Paper; Process for sizing*—R. Clavel, Basle, Switzerland. Eng. Pat. 101,855, July 27, 1916. (Appl. No. 10,644 of 1916.)

PAPER is sized by any of the usual sizing and fixing agents by drawing it through the upper part of baths in which the solutions are caused to foam so that the foam comes in contact with one or both sides of the paper. Foaming is produced by means of compressed air or gas diffusing from porous bodies such as pipes or plates of burnt clay or porous graphite. In the case of solutions of fixing agents which are not disposed to foam, foaming may be induced by the addition of saponin or other substances. When sizing with glue or casein, the foaming of the fixing bath may be produced by diffusing gaseous formaldehyde through water containing saponin.—J. F. B.

*Thread from the cocoons of the silkworm; Process for obtaining*—B. Loewe, Paris. U.S. Pat. 1,202,543, Oct. 24, 1916. Date of appl., June 18, 1912.

SEE Eng. Pat. 14,255 of 1912; this J., 1912, 1176.

*Sulphite-cellulose manufacture; Process of treating waste liquor from*—E. L. Rinman, Stockholm. U.S. Pat. 1,202,317, Oct. 24, 1916. Date of appl., Feb. 18, 1915.

SEE Ger. Pat. 285,752 of 1914; this J., 1915, 1139.

*Method of refining wool grease*. U.S. Pat. 1,201,042. See XII.

*Process of making emulsions*. U.S. Pat. 1,201,301. See XII.



## VI.—BLEACHING; DYEING; PRINTING; FINISHING.

### PATENTS.

*Bleaching fabrics in open form; Plant for* ——. C. Taylor, North Adams, Mass. U.S. Pat. 1,201,388, Oct. 17, 1916. Date of appl., Jan. 21, 1916.

A PLANT for bleaching and washing fabrics in open form consists of an apron-member, a series of vats provided with squeezing rollers, a series of overhead conveying rollers, a boiling kier provided with a circulating pump, and a souring kier provided with circulating and washing means. The apparatus is arranged in line, with the squeezing and conveying rollers coupled with each other and adapted to operate as a unit, rotating in one direction or the other for conveying a continuous run of fabric in either direction.—F. W. A.

*Bleaching and dyeing processes; Apparatus for* ——. A. Ross, London. Eng. Pat. 14,068, Oct. 5, 1915.

THE bleaching or dyeing vat is provided with an exterior siphon or circulation pipe, for withdrawing the contents from the upper level in the vat through a flared mouthpiece for collecting froth, and returning them to the lower part of the vat. The flow of the liquid may be accelerated by the introduction of a jet of steam into one limb of the siphon, and, after the flow has been established, it may be accelerated by heating one or both of the exterior limbs without introducing a supplemental fluid. The siphon may be constructed so that its upper portion is supported on trunnions, on an axis lying below the level of the liquid in the vat, so that it may be filled, for starting purposes, by tilting this upper portion.—B. N.

*Dyeing, washing, etc.; Machines for* ——. J. H. Milnes, Huddersfield, and The Simplex Patent Dyeing Machine Co., Ltd., Batley. Eng. Pat. 16,199, Nov. 17, 1915.

IN a dyeing machine divided into two compartments by a perforated plate and having a central circulating tube with a steam supply, air is introduced below the perforated plate through a perforated pipe extending round the vessel and controlled by an air-injector operated from a branch of the main steam supply pipe, for the purpose of agitating the liquid and lifting the material.—J. F. B.

*Colouring fibre; Process of* ——. C. S. Bentley, Plattsburg, N.Y. U.S. Pat. 1,202,852, Oct. 24, 1916. Date of appl., Feb. 17, 1916.

A SHADED colouring is imparted to fibre by impregnating the fibre with a solution of a colouring matter in a solvent which can be rapidly evaporated, and drying the treated fibre while it is suspended on an inclined impervious surface, the degree of angular inclination being varied during the drying process to regulate the action of gravity according to the graduation of colour desired.—F. W. A.

*Dyeing; Apparatus for shifting hanks of yarn in* ——. P. Hahn, Niederlahnstein, Germany. U.S. Pat. 1,202,061, Oct. 24, 1916. Date of appl., Oct. 10, 1913.

SEE Eng. Pat. 16,738 of 1913; this J., 1914, 641.

*Dyeing and printing with derivatives of naphthazarin; Process for* ——. G. Engi, Assignor to Soc. of Chem. Ind. in Basle, Switzerland. U.S. Pat. 1,202,821, Oct. 31, 1916. Date of appl., June 18, 1913.

SEE Eng. Pat. 12,790 of 1913; this J., 1914, 106.

*Pattern effects upon cotton fabrics; Process for the production of* ——. G. Heberlein, Wattwil, Switzerland. U.S. Pat. 1,201,961, Oct. 17, 1916. Date of appl., Feb. 17, 1916.

SEE Eng. Pat. 100,433 of 1916; this J., 1916, 1057. The use of sulphuric acid of over 50% B. (sp.gr. 1.538) is specified.

*Electrolytic apparatus for laundry and other hygienic purposes.* Eng. Pat. 101,820. See XI.

## VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

*Sulphuric acid; Proposed registering apparatus for the determination of the excess of oxygen in the exit gases from the lead chambers in the manufacture of* ——. J. B. Périgrin. Ann. Chim. Analyt., 1916, 21, 223—225.

EXIT gas from the lead chambers is continuously drawn into a wooden chamber of about 30 litres capacity. A light rubber balloon of about 10 litres capacity, filled with hydrogen and suitably varnished to prevent diffusion, is suspended inside the chamber by a fine wire attached to one arm of a pivoted beam, and any rise or fall of the balloon due to changes in the density of the gas in the chamber, is recorded, by the other and longer arm of the beam, on a drum which rotates once in 24 hours.—J. H. L.

*Hydrofluoric and hydrofluosilicic acids; Separation of* ——. J. G. Dinwiddie. Amer. J. Sci., 1916, 42, 421—430.

IN the titration of a solution of hydrofluoric acid with phenolphthalein as indicator, the presence of hydrofluosilicic acid as an impurity will produce an error in the proportion of 6 mols. of alkali consumed for each mol. of  $\text{H}_2\text{SiF}_6$ . Katz (this J., 1904, 562) has proposed a method for the separate estimation of these two acids in mixtures, based on a differential titration in aqueous solution and in presence of 50% alcohol with the addition of potassium chloride. If there were no complications the hydrofluoric acid would require the same amount of alkali in both titrations, while the hydrofluosilicic acid would consume in the second titration only one-third of the quantity required in the first, but Katz found that the hydrofluosilicic acid required considerably less than the theoretical amount of alkali in the second titration, and so a sliding correction was proposed to compensate for this error. Testing the method with pure hydrofluosilicic acid, the author found that the alcoholic titration required from 1 to 3% more than one-third of the alkali required in the aqueous titration, owing probably to the slight solubility of the precipitated potassium fluosilicate and its hydrolysis by the alkali. With known mixtures of hydrofluoric and hydrofluosilicic acids, the deficit attributed by Katz to the absorption of hydrofluoric acid by the precipitated potassium fluosilicate was observed, but in a smaller degree, viz., 1 mol. of hydrofluoric acid to 4 of hydrofluosilicic acid instead of 1:1 under the conditions recorded by Katz. Attempts to ascertain the error by determining the potassium in the precipitate or filtrate were unsuccessful because the precipitate contains an excess of potassium as well as free hydrofluoric acid. The addition of calcium chloride or calcium sulphate in order to fix the hydrofluoric acid as insoluble calcium fluoride before titration also yielded low results because the calcium fluoride was not sufficiently resistant to the free acid. Stolba's method (J. prakt. Chem., 109, 2) for the determination of water in fluosilicates by igniting with a weighed quantity of magnesium oxide was found

using the same concordant weighings could not be obtained. Great care is needed for the determination of free fluorine in mixed solutions of fluorides by reaction with ferric chloride, using thiocyanate as indicator (this J., 1918, 992), gives accurate results provided rigidly uniform conditions are observed, especially as regards neutrality, but when combined with the Katz method for the titration of fluosilicates in presence of alcohol and potassium chloride, the results are subject to the same kind of error, due to the absorption of free hydrofluoric acid.—J. F. B.

**Potash from alumina; The recovery of**—W. H. Waggaman and J. A. Cullen. Bull. 415, U.S. Dept. of Agric., 1916. 14 pages.

Complete separation of the potash from alumina after ignition of the mineral, is difficult, and the material contains relatively little potash, cheapness and efficiency in the extraction are essential for successful commercial development. Eleven samples of light-coloured alumina were ignited at different temperatures, and the residue leached with water. A temperature between 750° and 800° C. was found to be best for the subsequent complete extraction of the potash with the minimum amount of water; above 800° C. the potash was fixed, particularly in the presence of silica. Nothing is gained in the subsequent extraction by grinding the mineral finer than 60-mesh. It is suggested that it would be more economical to ship the mineral east, thus taking advantage of the lower freight rate for raw material, instead of extracting at the mines, though the freight charges would even then leave a very narrow margin of profit on the products in normal times.—B. N.

**Sodium peroxide; Action of**—on the oxides of carbon. C. Zenghelis and S. Horsch. Comptes rend., 1916, 163, 388–390.

Sodium peroxide reacts with carbon monoxide to give sodium carbonate only and with carbon dioxide to give sodium carbonate and oxygen. The second reaction produces less heat than the first, but is marked by a greater rise of temperature, probably owing to the formation of percarbonate as an unstable intermediate product (see Wolfenstein and Peltner, this J., 1903, 224). If a current of carbon dioxide be directed on a mixture of sodium peroxide and such readily oxidisable material as aluminium, cotton, wood, or sulphur, an extremely violent reaction sets in at once, sometimes resulting in an explosion, whilst a mixture of the peroxide and magnesium explodes violently under the same conditions, and iron burns to form sodium ferrate,  $\text{Na}_2\text{FeO}_4$ ; zinc and copper react only on heating.—F. SODN.

**Sodium peroxide; Chemical action of**—on hydrogen sulphide. C. Zenghelis and S. Horsch. Comptes rend., 1916, 163, 440–442.

The action of sodium peroxide on hydrogen sulphide is extremely vigorous, the peroxide becoming incandescent even when air has been previously expelled from the containing tube by a current of nitrogen. The products of the reaction depend on the conditions, whether a smaller or larger quantity of air is present and whether the peroxide is given a preliminary heating. In nitrogen gas, sodium sulphide, polysulphide, thiosulphate, and sulphate are produced, and, with a strong current of hydrogen sulphide, a little free sulphur is deposited.—B. N.

**Silver peroxynitrate; A new method for the study of**—M. J. Brown. J. Phys. Chem., 1916, 20, 680–702.

The author has devised an apparatus in which

silver peroxynitrate was prepared of greater purity than heretofore by electrolysis of 5% and 20% solutions of silver nitrate with currents of various strengths. The silver content of the anode deposit is slightly lower than corresponds to  $(\text{Ag}_2\text{O}_4)\cdot\text{AgNO}_3$ , possibly due to oxidised mother-liquor, though this cannot be the sole factor. The impurity present may be  $(\text{Ag}_2\text{O}_4)\cdot\text{H}_2\text{O}$  or  $\text{Ag}_2\text{O}_4\cdot\text{AgNO}_3$ . The author reviews the literature of the subject.—A. B. S.

**Sulphur; Action of**—on baryta in presence of water. L. Guiteau. Comptes rend., 1916, 163, 390–391.

The orange solution obtained by boiling a mixture of barium hydroxide (2 parts), sulphur (1 part), and water (25 parts) appears to contain barium pentasulphide,  $\text{BaS}_5$ ; but attempts to isolate the compound by concentrating the solution gave red prisms of the tetrasulphide,  $\text{BaS}_4\cdot\text{H}_2\text{O}$ , mixed with sulphur and thiosulphate; the pentasulphide is probably decomposed in accordance with the equation,  $2\text{BaS}_5 + 3\text{H}_2\text{O} = \text{BaS}_4 + \text{BaS}_2\text{O}_3 + 3\text{H}_2\text{S} + \text{S}$ .—F. SODN.

**Mercuric sulphide; Action of ammonium monosulphide on**—A. Christensen. Ber. deut. Pharm. Ges., 1916, 26, 261–266.

A COLOURLESS solution of ammonium sulphide becomes yellow owing to the presence of sulphur when poured on to many mercuric salts and on to yellow mercuric oxide. The precipitate in such cases always contains metallic mercury which was found to be equivalent in amount to the sulphur present in the ammonium sulphide solution, so that the reaction is due to the dissociation of the mercuric sulphide. The reaction is reversible, as the yellow solution at higher temperatures becomes colourless. Freshly precipitated mercuric sulphide on treatment with ammonium sulphide does not show the reaction.—T. C.

**Removal of sulphur from spent oxide.** Murphy. See 11A.

**Physical character of precipitated lead molybdate and its importance in the determination of molybdenum and lead.** Weiser. See XXIII.

**New cyanide works in Glasgow.** See Trade Report.

#### PATENTS.

**Polash; Process of producing**—[from greensand]. G. F. Von Kolnitz, Charleston, S.C. U.S. Pat. 1,201,396, Oct. 17, 1916. Date of appl. Jan. 7, 1916.

GREENSAND is preheated in an oxidising atmosphere to about 335° C. and then heated to a higher temperature in presence of calcium chloride and in a reducing atmosphere to form potassium chloride, which is recovered.—J. E. C.

**Alkali; Extracting**—from minerals. S. Peacock, Philadelphia, Pa., Assignor to Marden, Orth, and Hastings Co., Inc., New York. U.S. Pat. 1,202,215, Oct. 24, 1916. Date of appl. June 28, 1915.

MINERALS containing alkali metals (e.g., potassium) are melted in a closed furnace under pressure of the volatilised alkali and thus converted into an amorphous mass soluble in alkali. Alkali in solution is added in quantity sufficient, together with that already present, to react with all the silica contained in the mass to form a soluble alkali silicate, which is separated by filtration. The filtrate is treated with milk of lime forming an insoluble calcium silicate and an alkali hydroxide, the latter being separated and recovered.—J. E. C.

*Polish salts; Apparatus for the continuous separation of liquid from granular material, especially* — B. Schilde Maschinenfabr. und Apparatebau Ges. m.b.H., and S. Haun, Hersfeld, Ger. Pat. 294,275, Jan. 4, 1916. Addition to Ger. Pat. 389,774 (this J., 1916, 538).

AN angle iron is fixed to each of the scrapers near the lower end, on the rear side. The longer horizontal arm of the angle iron presses on the heap of material during the forward movement of the scraper, and squeezes out the liquor.—A. S.

*Rocks; Process for the treatment of volcanic* — C. Massaciu, Berlin, and A. Neumann, Charlottenburg, Germany. U.S. Pat. 1,202,556, Oct. 24, 1916. Date of appl., May 9, 1913. Renewed Aug. 9, 1916.

To render volcanic rocks of a vitreous character capable of exchanging their bases, they are treated with steam under pressure in the presence of alkalis.—J. H. J.

*Salt from sea-water; Process for the extraction of* — L. P. Bassett. Fr. Pat. 477,928, July 8, 1914.

SEA-WATER is allowed to evaporate as a very shallow layer on an impervious floor on to which it is fed in such quantity that evaporation is completed each day, the salt being then removed; or, a continuous flow of sea-water is maintained over a gently sloping floor, so as to furnish a constant supply of strong brine by progressive evaporation, and the product is filtered and further evaporated; or, evaporation is wholly or partially effected by atomising in a current of air or by supplying sea-water in atomised form at a desired height above the evaporation floor.—F. Sodn.

*Ammonium nitrate; Process of manufacturing* — by treating with alcohol the mother liquor from the manufacture of sodium carbonate from sodium nitrate in the ammonia process, A. Ricard. (A) Fr. Pat. 479,164, May 22, 1915, and (B) First Addition, dated June 9, 1915.

(A) The mother liquor containing ammonium nitrate and sodium nitrate is evaporated to dryness or until the temperature reaches 140° C. and the residue agitated with alcohol (95–98%) at 70°–80° C. Ammonium nitrate is thereby dissolved and recovered by cooling the solution and recrystallising, whilst the sodium nitrate, remaining insoluble, is returned to the ammonia-soda process. The proportion of ammonium nitrate in the crude liquors or original mother liquors may be increased by adding ammonium chloride, which reacts with the sodium nitrate present to give a precipitate of sodium chloride; or ammonium sulphate may be similarly employed. Chlorides and sulphates which accumulate in the mother liquors may be removed by treating the alcoholic solution with lead nitrate. The recrystallised product contains 95% of ammonium nitrate. (B) The mother liquor is agitated with alcohol at 70° C., so as to precipitate sodium nitrate, leaving a solution of ammonium nitrate from which the alcohol is recovered by fractional distillation and the nitrate by crystallisation; or, the proportion of alcohol is adjusted to give an alcoholic solution of ammonium nitrate superposed upon an aqueous solution of sodium nitrate, which latter is run off and returned to the ammonia-soda process.—F. Sodn.

*Alumina; Process of preparing pure* — A. Lambert. Fr. Pat. 477,988, July 10, 1914.

A MIXTURE of bauxite, with sufficient calcium oxide or calcium carbonate to convert the aluminium present into calcium aluminate, is fused in an electric furnace, the powdered product heated with sodium carbonate solution, and the filtered

solution of sodium aluminate treated by a known method to precipitate the alumina.

—F. Sodn.

*Titanic oxide; Process of recovering* — L. E. Barton, Niagara Falls, N. Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. 1,201,541, Oct. 24, 1916. Date of appl., Mar. 7, 1916.

TITANIC oxide is obtained from titaniferous-ferruginous material by heating the material in presence of an alkali sulphide to form ferrous sulphide or ferro-sodium sulphide. The resulting product, containing also titanic oxide and alkali titanate, is incorporated with an aqueous bath and treated with sufficient chlorine to ensure decomposition and solution of the alkali sulphide and ferrous sulphide. The chlorine may be produced by adding sodium chloride to the bath and electrolyzing.—J. E. C.

*Aluminium chloride; Recovery of* — [from oil-containing residues]. A. McD. McAfee, New York. U.S. Pat. 1,202,081, Oct. 24, 1916. Date of appl., Mar. 2, 1915.

IN working up the residues from the treatment of oil with anhydrous aluminium chloride, the latter is revived by extracting the oil-containing residues with a volatile solvent and expelling the volatile solvent from the extract.—J. E. C.

*Ammonia; Production of* — F. Haber and R. Le Rossignol, Karlsruhe, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,202,995, Oct. 31, 1916. Date of appl., Aug. 13, 1909.

SEE Fr. Pat. 406,943 of 1909; this J., 1910, 488.

*Zinc oxide; Process for the production of* — E. Hunebelle, Paris. U.S. Pat. 1,201,586, Oct. 17, 1916. Date of appl., May 23, 1914.

SEE Eng. Pat. 14,226 of 1914; this J., 1915, 1009.

*Sulphate, sulphite, and oxide directly from the sulphide of lead; Process for the manufacture of the* — J. Githam, London. U.S. Pat. 1,201,955, Oct. 17, 1916. Date of appl., Mar. 21, 1916.

SEE Eng. Pat. 5299 of 1915; this J., 1916, 698.

*Furnaces.* Eng. Pat. 101,757. See I.

*Process of recovering alkali [in cement manufacture].* U.S. Pat. 1,202,327. See IX.

## VIII.—GLASS; CERAMICS.

*Refractory materials.* R. Hadfield. Faraday Soc., Nov. 8, 1916.

AFTER reviewing the available information on refractory materials, the author describes briefly the properties of zirconia, which he considers will be of much importance in the future. Magnesite has been found useful for nozzles for steel ladles. The diameter of a magnesite nozzle remained unaltered at 1 in. even after 28 tons of steel had been poured through it, whereas that of an ordinary fireclay nozzle increased to 2 in. The most noticeable feature of the address is the tabulated list of 30 volumes and 74 papers dealing with the subject and five tables dealing with analyses of various refractory materials, including furnace sands. The address is illustrated with nine photomicrographs of refractory sands.—A. B. S.

*Firebricks; The texture of* — J. W. Mellor. Faraday Soc., Nov. 8, 1916.

THE texture is one of the most important qualities of a firebrick, because if the chemical composition

and refractoriness are satisfactory, the characters of the brick will depend on the texture, i.e., on the proportions of coarse and fine grains and the spaces between them. These grains are composed of (a) felspathic and micaceous fluxes, (b) granules of clay proper, (c) grains of quartz, and (d) accidental impurities. When a clay is burned in a kiln the fluxes begin to melt at about 900° C. and then attack the surfaces of the clay and quartz grains. At a still higher temperature the clay and quartz react on each other and bind the material together into a solid mass of great strength. This fluxing or vitrification is a time reaction which is favoured by high temperature, by fineness of grain, and by pressure which brings the particles closer together. Consequently, the coarser the grain the higher the softening temperature and the refractoriness. Grog or burned clay, being coarser than raw clay, has a higher softening point, so that the refractoriness of a clay may be raised by adding grog made of the same clay. Coarse-grained materials are less liable to crack when exposed to sudden changes of temperature but they are mechanically weak and liable to rapid destruction by abrasion or corrosion. To resist the latter, fine-grained materials are essential. They may be less refractory, but true refractoriness is often of secondary importance and must be sacrificed to secure greater durability under furnace conditions. Machine-made firebricks are commonly regarded as inferior to those made by hand. This is largely due to unfair comparison, the material for the latter being more suitable than that supplied to the machines. Pugged clay is often irregular in texture and machine-made bricks are frequently manufactured from clay which has not been allowed to stand long enough to mature properly. Uniformity of texture is so essential that its importance cannot be over-emphasised. The texture may be judged by polishing one face of a brick or other article, and cementing a glass plate on it by means of hot Canada balsam.—A. B. S.

*Grog and clay; Determination of — in unburned firebricks.* R. Lessing. Faraday Soc., Nov. 8, 1916.

THE grog and the clay may be separated by elutriating the sample with water, the flow of which is adjusted that grog particles and the coarser constituents of the clay (sand, shale, carbonaceous substances, etc.) are left in the residue. The clay carried over by the water is separated by settling, and the coarse residue is dried and subjected to a grading test. Comparative tests with English and German retort mixtures showed that the latter are characterised by a larger proportion of grog (86%, as against about 35% in the English mixtures) and by absence of shale, coal, or other coarse impurities from the clay, indicating that the clay had been submitted to some preliminary purification.

*Silica as a refractory material.* C. Johns. Faraday Soc., Nov. 8, 1916.

SILICA sands used as refractory materials are employed in the form in which they are received from the quarries, but better results would be obtained if they were carefully graded. A refractory sand for furnace linings and hearths should assume its normal angle of repose when thrown into a highly heated furnace and should frit at the temperature of the furnace, but should not melt or soften unduly when the charge is introduced and the furnace is used. Pure silica is useless for these purposes as its softening point is too high. The following maxima of impurities are allowable:—2% alumina,  $\frac{1}{2}$ % ferric oxide,  $\frac{1}{2}$ % lime,  $\frac{1}{2}$ % magnesia, and 0.15% alkalis. Alkalis are specially objectionable as they render the sand too fusible. Until two years ago it was

customary to use Belgian sands almost exclusively for furnace work, partly because of their intrinsic value but chiefly because they were cheaper than English sands of corresponding character. The latter have now proved efficient substitutes. Silica bricks consist of particles of silica rock united by lime or other bond. These bricks are mineral aggregates of extreme complexity, notwithstanding the apparent simplicity of their composition, and their properties cannot be predicted with certainty from the results of the investigations at the Geophysical Institute at Washington on the binary system lime-silica (this J., 1907, 95). The variations in the physical properties of silica bricks are less due to differences in chemical composition than to undetected departures from correct manipulation in the various stages of manufacture. To eliminate these variations it is necessary to investigate the most suitable sizes of grains so as to obtain a satisfactory texture, and to determine the time-temperature curves of the burning, so as to ascertain what mode of heating is most suitable and to use a standard time-temperature curve as a guide for future work. The presence of 15–17% of magnetite in bricks which have been in use for some time coincides with a notable increase in the resistance of the brick to furnace conditions. The magnetite appears to be free and merely an indicator of other changes taking place in the structure of the bricks which improve their value.—A. B. S.

*Thermal conductivity of materials employed in furnace construction.* E. Griffiths. Faraday Soc., Nov. 8, 1916.

THE author reviews the work of Wologdine (this J., 1909, 709), Marshall (Met. and Chem. Eng., Feb., 1914), Dougill, Hodsman, and Cobb (this J., 1915, 465), and B. Dudley (this J., 1915, 815), and is dissatisfied with each of their methods. He proposes a method in which ordinary sized specimens (such as firebricks) are heated by immersing one face in a bath of molten metal heated electrically so as to secure a uniform temperature throughout the face to be tested, and a flow calorimeter consisting of numerous turns of piping attached to a water supply of constant temperature and pressure is applied to the cooler face of the specimen. The rate of flow of the water is adjusted to produce an equal temperature rise in equal intervals of time. The temperature of the cooler face of the specimen is measured by means of differential couples of 6 pairs of copper-constantan immersed in the flowing water. The calorimeter is fitted with a guard ring which is separated from it by a narrow gap about 1 mm. wide filled with mica plates set on edge. This arrangement gave results which agreed with those obtained by placing the hot face of the specimen on an iron plate, which formed one of the walls of a large muffle, and determining the temperature of this face by means of a bare nickel copper-nickel couple cemented into it, but the use of a molten metal bath gave more concordant results. In working with thick samples it is necessary to allow ample time for equilibrium to be attained; this sometimes takes several days. Tests on a brick made of diatomite bonded with a little clay showed that the conductivity in C.G.S. units between 105° and 502° C. rose steadily from 0.000310 to 0.000461. Tests on a slag-wool mat (CaO 48, SiO<sub>2</sub> 43 per cent.) showed a conductivity between 194° and 476° C. of 0.000191 to 0.000342. The conductivity-temperature graphs of both diatomite and slag wool were straight lines. By the same method, the conductivity of a mixture of basic carbonate of magnesium with 15 per cent. of asbestos (such as is used for covering steam-pipes) is about 0.00015

between 20° and 350° C. At the latter temperature the carbonate decomposes, and at a dull red heat the mixture falls to a loose powder of double the conductivity.—A. B. S.

**Porcelain; Constitution and micro-structure of** — A. A. Klein, U.S. Bureau of Standards, Tech. Paper No. 80. J. Franklin Inst., 1916, 182, 683-685.

A MICRO-PETROGRAPHIC study was made of porcelains prepared to correspond to those made in the United States, England, Germany, France, Austria, Denmark, and Japan, the bodies being burned at various temperatures. Kaolin appears to be homogeneous at temperatures below 1200° C., but between 1200° and 1400° C. it dissociates completely into silica and amorphous aluminium silicate. At about 1450° C. the latter inverts into sillimanite ( $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ ). In mixtures of quartz and feldspar, below 1340° C. the quartz dissolves slightly in the fused feldspar; at 1460° C. it is completely dissolved in mixtures of equal parts of quartz and feldspar. In mixtures of kaolin and feldspar, the kaolin is completely dissociated at 1340° C. At 1460° C., 10% of kaolin is entirely soluble in the fused feldspar. With higher concentrations of kaolin the amount of crystalline sillimanite increases. In mixtures of quartz, clay, and feldspar, at 1310° C. the feldspar is present as glass, the clay is completely dissociated into silica and amorphous sillimanite with few crystals, and the quartz remains undissolved, but if these mixtures are burned at 1380°-1400° C. the quartz enters almost completely into solution and the sillimanite is converted into the crystalline form. No cristobalite or tridymite has been observed. The changes involved in burning commercial bodies are identical with those in bodies prepared in the laboratory. The constitution and micro-structure of porcelain depend on the temperature of burning, and to a less extent on the time of heating.—A. B. S.

**Method of measuring the viscosity of very viscous substances.** Feild. See XXIII.

#### PATENTS.

**Furnace for producing glass.** D. S. Beebe, Assignor to The Vitrolite Co., Parkersburg, W. Va. U.S. Pat. 1,199,044, Sept. 26, 1916. Date of appl., Dec. 11, 1914.

A HORIZONTAL glass furnace is provided at the bottom with a central well or catch-basin towards which the floor of the furnace slopes. The capacity of the well is slightly greater than that necessary for the "green" material remaining after the fusion of a charge, the area of the well mouth being only a small fraction of the cross-sectional area of the furnace.—W. E. F. P.

**Aluminous abrasives; Process of treating certain** — T. B. Allen, Assignor to General Abrasive Co., Niagara Falls, N.Y. U.S. Pat. 1,199,041, Sept. 26, 1916. Date of appl., Jan. 27, 1916.

AN artificially prepared, granular, aluminous abrasive containing iron, silicon, and titanium as impurities, is mixed with an oxygen-liberating salt and heated to between 1300° and 1500° C. to convert the impurities into a ferrous-ferriic titanosilicate.—W. E. F. P.

**Abrasives; Manufacture of crystallised** — T. B. Allen, Toronto, Ont., Assignor to General Abrasive Co., Inc., Niagara Falls, N.Y. U.S. Pat. 1,199,042, Sept. 26, 1916. Date of appl., July 24, 1916.

ALUMINA, melted in an electric furnace, is poured into preheated moulds and allowed to cool, the

pouring temperature being regulated, according to the crystalline characteristics required in the finished product.—W. E. F. P.

**Furnaces.** See Pat. 1,017,557. See I.

**Kiln.** U.S. Pat. 1,200,132. See I.

#### IX.—BUILDING MATERIALS.

**Plaster of Paris.** L. A. Keane. J. Phys. Chem., 1916, 20, 701-728.

WHEN gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is heated slowly and steadily with constant stirring, there is a halt in the rise of temperature at 99° C., and under some conditions another halt at 139° C. There is also an inversion into plaster of Paris, ( $\text{CaSO}_4$ ), at 107° C. and 971 mm. mercury pressure, though the temperature may be raised to 200° C. for some hours without this inversion being complete. On prolonged heating at 110° C. complete conversion into anhydrite ( $\text{CaSO}_4$ ) occurs. In the German practice in making plaster of Paris, the maximum temperature is 130° C., in American practice 200° C. is reached, and in English practice 110°-120° C. These differences are possible because of the influence of time and temperature on the rate of inversion and the slowness with which gypsum and plaster develop their true vapour pressures. The quality of the plaster undoubtedly varies with the temperature of formation. Only one modification of anhydrous calcium sulphate exists, but its properties vary with the degree of agglomeration and therefore with the conditions of formation. This is the essential ingredient in dead-burned plaster. On grinding the anhydrous sulphate it may be made to set, the rate of setting depending on the size of the particles. If the latter are only 0.005 mm. diameter, the dead-burned plaster will set rapidly. Typical flooring plasters (Estrichgips) are dead-burned plasters which have been finely ground. The true volume occupied by set, or crystallised, plaster is less than the sum of the volumes of the plaster and water used, but as plaster casts are porous the apparent volume is greater and therefore enables casts to take the form of the mould accurately. The setting of plaster may be retarded by adding flooring plaster, colloids, or any substance which will decrease the solubility of the gypsum. The setting may be accelerated by adding substances which increase the solubility of the gypsum.—A. B. S.

#### PATENTS.

**Lumber; Process of curing** — E. D. Sidman, Assignor to The Sidman Co., Rochester, N.Y. U.S. Pat. 1,199,120, Sept. 26, 1916. Date of appl., Mar. 3, 1914.

GREEN lumber is subjected to an atmosphere of 80°-95° humidity, at 60°-90° F. (15°-32° C.) until the moisture penetrates the wood and dissolves the detrimental substances; the temperature is then increased to about 165° F. (74° C.) and the same humidity maintained until the solution of detrimental substances is expelled from the wood by expansion, after which the humidity is gradually decreased and the final drying effected at the higher temperature.—W. E. F. P.

**Forms (moulds) for producing castings or objects from materials of any kind; Compound or mixture from which to make** — J. Ringel, Strasbourg, Germany. U.S. Pat. 1,200,133, Oct. 1, 1916. Date of appl., May 21, 1913.

THE material is composed of dehydrated gypsum 54, and puzzuolana, 96 to 183 parts, to which an indifferent material may also be added for the purpose of imparting body to the mixture.—W. E. F. P.

**Alkali; Process of recovering** — [in cement manufacture]. H. S. Spackman, Ardmore, and E. L. Conwell, Chester, Pa. U.S. Pat. 1,202,327, Oct. 24, 1916. Date of appl., Mar. 15, 1916.

**Alkali**; compounds are recovered from cement-making materials by calcining the latter at high temperatures by means of fuels containing sulphur in presence of sufficient water vapour to convert the volatilised potash into soluble sulphate, which is recovered from the cement-kiln gases.—J. E. C.

**Tar-macadam roads; Manufacture of a binding medium for** —. A. Studer, Neuchâtel, Switzerland. Ger. Pat. 294,481, July 4, 1915. Addition to Ger. Pat. 294,045 (this J., 1916, 1167).

A Mixture of 15 parts of asphalt-mastic, 25 of asphalt rock ("crab"), and 10 of bitumen, together with a small quantity of tar, is boiled for about 2 hours, and 50 parts of tar which has been previously heated to 150° C. to expel benzol and light oils, is then incorporated with the mass.—A. S.

## X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

**Copper; Electrolytic refining of** —. F. L. Antisell and S. Skowronski. Amer. Inst. of Metals, Sep., 1916. [Advance proof.] 11 pages.

THE analysis of anodes of blister copper is given as: Cu, 99.25%; Ag, 70.0 oz. per ton; Au, 0.25 oz. per ton; As, 0.060%; Sb, 0.52%; Ni, 0.050%; Pb, 0.053%; Fe, 0.058%; Bi, 0.003%; S, 0.004%; Se, 0.008%; Te, 0.038%; O, 0.100%. The electrolyte used in refining contains 16% of copper sulphate and 12% of free sulphuric acid; nickel, cobalt, iron, zinc, and arsenic dissolve from the anodes and foul the electrolyte, whilst the other impurities pass into the slimes. The electrolyte is purified by crystallisation, or by electrolysis to recover the copper, nickel, and free acid. Silver, gold, platinum, palladium, selenium, and tellurium are recovered from the slimes. The cathodes are afterwards melted in reverberatory furnaces of 200–250 tons capacity, and the copper oxidised to bring it to the state of "set copper" containing 4 to 5% of cuprous oxide, in order to get rid of sulphur, and then poled to reduce the cuprous oxide to 0.3 to 0.6%. A typical analysis of refined electrolytic copper is given as:—Cu, 99.93%; Ag, 0.001%; Au, 0.00001%; O, 0.045%; S, 0.003%; Fe, 0.0035%; Ni, 0.0015%; As, 0.0015%; Sb, 0.0015%.—B. N.

**Tin ores; Analysis of** —. T. F. Golick. Eng. and Min. J., 1916, 102, 827.

THE ore is fused with potassium carbonate and sulphur, the melt leached with hot water, filtered, and the filtrate evaporated with sulphuric acid till fumes appear. The residue is treated with hydrochloric acid (1:1), and hydrogen peroxide added to ensure complete conversion into stannic chloride. The solution is precipitated with hydrogen sulphide, and the washed precipitate treated, together with the filter, with a known excess of standard iodate in presence of 30% by volume of strong hydrochloric acid, the excess being titrated back with standard iodide (this J., 1915, 608). The reaction is represented by the equation  $\text{SnS}_2 + \text{KIO}_3 + 6\text{HCl} = \text{SnCl}_4 + \text{S} + \text{KCl} + \text{ICl} + 3\text{H}_2\text{O}$ . (See also Hallett, this J., 1916, 1087.)—W. R. S.

**Platinum production in Colombia.** U.S. Comm. Rept., suppl. No. 42A, Nov. 13, 1916.

THE platinum industry of Colombia has expanded very rapidly during the last few years; in 1907

only 245 troy oz. of the metal was exported, whilst in 1915 the exports amounted to 11,046 oz., valued at \$494,888. The whole production came from the Choco and was panned out of the gravels of small streams. The area of the platinum-producing zone is small; it begins near the mouth of the Condoto River and extends a short distance north of the Rivers Nemotá, Bebaramá, and Neguá. The whole zone is about 90 miles long by 30 miles wide. During the latter part of last year a company was formed to exploit platinum-bearing lands on the San Juan River, and will shortly commence operations.

**Gallium; Electrolysis and purification of** —. H. S. Uhler and P. E. Browning. Amer. J. Sci., 1916, 42, 389–398. (See also this J., 1916, 544.)

GALLIUM was obtained in an arborescent form instead of in liquid globules, by electrolysis a solution of gallium hydroxide in caustic soda cooled to 0° C.; the cathode consisted of platinum wire sealed into a glass tube with 2 mm. projecting at the lower end. Photographs of the gallium trees and of the complete arc spectrum of gallium are reproduced and described. A very pure product was obtained by ten successive crystallisations of the caesium-gallium alum. Zinc may be completely eliminated by volatilisation, by heating gallium in a current of dry hydrogen with the full heat of a Bunsen burner.—W. R. S.

**Radium in carnotite ores; Experiments on the concentration of** —. A. G. Loomis and H. Schlundt. J. Ind. Eng. Chem., 1916, 8, 990–996. (See also this J., 1916, 837.)

MOST of the experiments were made with a low-grade ore containing 1.66%  $\text{U}_3\text{O}_8$ , 4.03%  $\text{V}_2\text{O}_5$ , and  $4.88 \times 10^{-3}$  gm. Ra per gm. By heating 5 parts of the ore, ground to pass a 20-mesh sieve, with 4 parts by weight of crude sulphuric acid of 60° B. (sp.gr. 1.71) at 250°–300° C. for 15–30 mins., then stirring with water, and separating the insoluble matter in fractions by differential sedimentation, 87% of the radium was concentrated in the finer fractions and practically all of the uranium and vanadium was obtained in solution. Fusion of the ore with sodium bisulphate or with salt-cake, followed by treatment with water and differential sedimentation, gave a concentrate containing about 86% of the radium. The concentrate obtained by digestion with saturated aqueous sulphurous acid and subsequent differential sedimentation, contained about 85% of the total radium. In the product obtained after treatment with sulphuric acid, the radium concentration was from 20–28 times that of the ore, in the sodium bisulphate or salt-cake concentrate 15–20 times, and in the sulphurous acid concentrate 10–12 times. By digesting the sulphuric acid or salt-cake concentrate with excess of concentrated sulphuric acid, filtering and diluting with water, or by fusing with sodium and potassium carbonates, dissolving the radium-barium carbonate in hydrochloric acid, and precipitating with sulphuric acid, a crude sulphate was obtained containing 80% of the radium content of the ore at a concentration from 150 to 300 times the original value. In determining approximately the radium content of tailings, comparison should be made against standardised samples of tailings; low results are obtained if ore samples be used as standard for comparison.—A. S.

**Flotation process; An explanation of the** —. A. F. Taggart and F. E. Beach. Amer. Inst. Min. Eng., Sept., 1916. Met. and Chem. Eng., 1916, 15, 518–523.

FROM a practical and theoretical study of physical phenomena involved in flotation, viz., surface

tension, adsorption, adhesion, and viscosity, it is concluded that gas bubbles cling with greater persistence to sulphide than to gangue particles because of the smaller potential at the gas-sulphide contacts; that oil replaces water at sulphide surfaces, whereas the reverse occurs at gangue surfaces; and that water replaces gas more readily at oiled than at clean solid surfaces. The surface tension of water is lowered by the addition of any contaminant (oil), the latter becoming concentrated at the air-liquid surface. At a gas-liquid surface, adsorption lowers the surface tension and increases the viscosity, but at a liquid-liquid surface it produces a film having a viscosity higher than that of the bulk of either liquid. The viscosity of a film is markedly increased by the presence of finely-divided solid matter. The application of these conclusions to commercial flotation processes is discussed.

—W. E. F. P.

*Antimony-gold ore; Flotation tests on an* — E. R. Pilgrim. Eng. and Min. J., 1916, 102, 820.

THE ore from the Sliscovich mine (Alaska) contains Au 0.1–0.2 oz., and Sb 18–40% as stibnite very intimately intermixed with quartz. Concentration by gravity having proved a failure, the ore was tested on a Case experimental machine, the separation of the gold and stibnite by flotation being successfully accomplished under the following conditions: pulp ratio, 1:6; size of ore, –60 mesh; proportion of wood creosote 0.2% and of acid 0.3%. The flotation concentrate carried 84% of the antimony, and the tailing 80–100% of the gold.

—W. R. S.

*A new soda-lime tube. A new absorbent for carbon dioxide in steel analysis.* Kelley. See XXIII.

*Method of measuring the viscosity of very viscous substances.* Feild. See XXIII.

#### PATENTS.

*Removing oxide or rust from the surface of iron or steel; Electrolytic method for* — P. Marino, London. Eng. Pat. 101,687, Oct. 7, 1915. (Appl. No. 5628 of 1916.)

THE iron or steel articles are immersed in an electrolyte, preferably heated, consisting of an aqueous solution of phosphoric acid, or of a phosphate to which phosphoric acid has been added; one terminal of a source of alternating current is connected to the articles, the opposite terminal being connected to a conductive plate of carbonaceous material also immersed in the electrolyte.

—B. N.

*Composite ferrous and non-ferrous bodies; Process of forming* — J. M. Roth, Pittsburgh, Pa. U.S. Pat. 1,190,429, Sept. 26, 1916. Date of appl., Mar. 2, 1916.

A CORE of ferrous metal is heated to welding temperature while disposed centrally in a vertical open-top mould, and molten non-ferrous metal is introduced after the wall of the mould has been cooled rapidly to below the melting point of the latter metal.—W. E. F. P.

*[Steel] pipe; Method of and apparatus for annealing crystallised* — H. A. Bardeen, Assignor to The Bardeen Corporation, Los Angeles, Cal. U.S. Pat. 1,201,134, Oct. 10, 1916. Date of appl., Feb. 11, 1915.

CRYSTALLISED drill pipe is heated to an annealing temperature by means of an alternating current in an apparatus provided with a treating platform so arranged as to prevent distortion of the pipe during heating. The pipe is subsequently rolled into an enclosed leer forming an extension of the platform, and slowly cooled.—W. E. F. P.

*Case-hardening material and process of making same.* M. Kirchhoff, jun., Chicago, Ill. U.S. Pat. 1,201,058, Oct. 10, 1916. Date of appl., Oct. 9, 1915.

LEATHER is heated in the presence of moisture until it becomes sticky or gluey, when the mass is dried and powdered. A mixture of the powder (100) with calcium hydroxide (5) and a sodium salt (5 parts by weight) is then compacted in a liquid-sealed retort and heated at 1400°–1500° F. (760°–816° C.) until charred.—W. E. F. P.

*[Iron] magnetic material; Process of making* — W. E. Ruder, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,201,633, Oct. 17, 1916. Date of appl., Apr. 6, 1916.

A MAGNETICALLY non-ageing material, having high permeability and low hysteresis loss, is prepared by annealing ordinary commercial iron at 760°–1200° C. (below the melting point) under oxygen-removing conditions and at atmospheric pressure or in a partial vacuum (2–2.5 mm. of mercury).

—W. E. F. P.

*Soldering; Electric arc* — E. H. Jones, London. Eng. Pat. 14,468, Oct. 13, 1915.

CARBON is added to mild steel electrodes, to be used for electric arc soldering, by a case-hardening process, or nickel, aluminium, or other metal is deposited on the electrodes by an electroplating process, so as to effect the ultimate union of the required proportion of added carbon or metal. An additional quantity of aluminium, in the form of powder, may also be added with advantage to the fusible coating during the soldering.—B. N.

*Melting furnace.* A. C. Ionides, jun., London. Eng. Pat. 15,322, Oct. 30, 1915.

A VERTICAL tubular furnace for melting scrap metal, communicates at the top with an annular encircling downtake flue, and is provided at its base with a crucible for receiving the molten metal. A feeding tube leads from the top of the furnace into the crucible. The latter stands on a base plate which may be lowered to remove the crucible from the furnace, or an outlet may be provided for running off the molten metal without removing the crucible from the furnace. The furnace may be heated by a self-burning mixture (see Eng. Pat. 15,455 of 1909).—W. R. S.

*Electrolytic refining or extracting process.* United States Metals Refining Co., Chrome, N.J., Assignees of F. R. Pyne, Elizabeth, N.J., and H. M. Green, Chrome, N.J., U.S.A. Eng. Pat. 100,318, April 19, 1916. (Appl. No. 5750 of 1916.) Under Int. Conv., Apr. 20, 1915.

AN electrolyte containing more than one metal constituent is electrolysed, using either soluble or insoluble anodes, and is allowed to stratify to a determined degree, the strata containing the concentrated primary and secondary constituents being led off separately. The relative concentrations of the constituents of the several strata are controlled by regulating the outflow of the separate portions. The portion containing the concentrated primary constituent may be returned to the electrolytic tank, or to other tanks, and the portion containing the concentrated secondary constituents is treated directly to eliminate from it the primary constituent, and may then undergo further treatment for the recovery of the secondary constituents. For example, in electrolytic copper refining the concentration of the copper is higher in the lower stratum of liquid and that of the secondary constituents is higher in the upper stratum. The upper stratum of liquid is transferred to a tank or tanks where it is electrolysed with insoluble anodes to recover the copper. (See also this J., 1915, 1096.)—B. N.

[Copper] alloy. J. Monville, Assignor to J. J. Ethier and W. Kline, Hubbell, Mich. U.S. Pat. 1,199,200, Sept. 26, 1916. Date of appl., Apr. 27, 1916.

AN alloy containing approximately Cu 05.5, Fe 3, Sn 0.625, Zn 0.625, and Ni 0.25%.—W. E. F. P.

Copper; Process of recovering — from solution. G. A. Schroter, Denver, Colo., and W. C. Laughlin, Nogales, Ariz. U.S. Pat. 1,200,534, Oct. 10, 1916. Date of appl., Apr. 29, 1915.

THE liquid is treated with a solution of calcium hydroxide and filtered, and the precipitate is calcined to render iron oxide insoluble and then treated with sulphuric acid to dissolve the copper oxide.—W. E. F. P.

Copper; Hydrometallurgy of —. E. R. Weidlein, Thompson, Nev., Assignor to Metals Research Co., New York. U.S. Pat. 1,201,899, Oct. 17, 1916. Date of appl., Aug. 31, 1915.

A SOLUTION of copper sulphate, containing not more than 1.5% Cu, produced by leaching ore, roasted matte, etc., with dilute sulphuric acid, is neutralised and then circulated, with a quantity of sulphur dioxide not exceeding the weight of copper present, through a precipitator maintained at 150° C. and under a pressure of 100 lb. per sq. in. The effluent from the precipitator is circulated in heat-interchanging relation with fresh in-going solution and then used for leaching a further quantity of ore.—W. E. F. P.

Metals [zinc]; Process of recovering —. C. J. Reed, Glenside, Pa. U.S. Pat. 1,200,025, Oct. 3, 1916. Date of appl., Aug. 25, 1915.

IN a process for recovering zinc from its aqueous solutions, the metal is electro-deposited in a cathode of mercury from which it is then redissolved and deposited upon an inert cathode. The solution of metal by local action from the amalgam anode is compensated by supplying thereto the requisite additional quantities of amalgam.—W. E. F. P.

Metals from their ores; Apparatus for extracting —. J. C. Greenway, Warren, Ariz. U.S. Pat. 1,200,832, Oct. 10, 1916. Date of appl., Mar. 31, 1915.

THE apparatus consists of a series of leaching tanks, each having an inlet and outlet for the solvent and a separate pump for circulating the latter repeatedly through the charge of ore in an upward direction. Means are also provided for passing the solution from each tank through a precipitator, for advancing a portion of the solution from one tank to the next in the series, and for shutting off any of the tanks from the supply connection.—W. E. F. P.

Cyaniding-tower. A. F. Tanner, Greenfield, Wis., Assignor to Ideal Continuous Cyaniding Process Co., Davenport, Iowa. U.S. Pat. 1,201,386, Oct. 17, 1916. Date of appl., July 14, 1915.

A SERIES of inclined pans are mounted on a framework, one above another, with the lower end of each pan beneath the upper end of the succeeding pan. The lower end of each pan is of concave form, and a cylinder provided with lifting blades rotates across the concave portion and raises the material into the upper end of the pan above. Means are provided for varying the clearance space between the cylinders and the pans, and for heating the pans.—A. S.

Disintegrating ores and other materials; Apparatus for —. A. Feust, New York. U.S. Pat. 1,202,278, Oct. 24, 1916. Date of appl., July 6, 1914; renewed Sept. 2, 1916.

THE apparatus consists of a rotary, egg-shaped

chamber, half filled with comparatively small crushing bodies (flints) of different sizes, and mounted horizontally upon hollow trunnions through which ore is admitted and discharged. The inlet is situated at the wide or hemispherical end, and during rotation the crushing bodies become arranged according to size, the larger ones occupying the wider part of the chamber.—W. E. F. P.

Concentrating ore by flotation; Method of —. G. Gröndal, Djursholm, Sweden, Assignor to Beer, Sondheimer & Co., Frankfurt, Germany. U.S. Pat. 1,202,512, Oct. 24, 1916. Date of appl., Jan. 18, 1916.

THE flotation agent (oil) is atomised by a stream of heated gas under pressure, the arrangement forming an injector by means of which a large quantity of another gas (air) is drawn in and mixed with the gas-oil mixture. The gaseous mixture is then forced in an upward direction through one compartment of the flotation machine against a downward current of finely divided ore suspended in water.—W. E. F. P.

Ores; Concentration of —. F. J. Lyster, Broken Hill, N.S.W., Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pats. (A) 1,203,374 and (B) 1,203,375, Oct. 31, 1916. Date of appl., July 8, 1916.

(A) The ore pulp is agitated and aerated in presence of a quantity of sodium chloride sufficient to facilitate the formation of a froth of concentrates. Another frothing agent and/or an alkaline hydroxide may also be added. (B) A froth of concentrates is obtained by agitating and aerating the ore pulp, with or without addition of a small proportion of a frothing agent, in presence of a sufficient quantity of an alkaline hydroxide, such as calcium hydroxide, to act as "a selectivity modifying agent."—A. S.

Electric welding; System of —. D. H. Wilson, Franklin Township, N.J., U.S.A. Eng. Pat. 17,834, Dec. 21, 1915.

SEE U.S. Pat. 1,187,410 of 1916; this J., 1916, 849.

Tin and its salts; Electrolysis of —. A. E. Battle, London. U.S. Pat. 1,202,149, Oct. 24, 1916. Date of appl., May 24, 1915.

SEE Eng. Pats. 14,514 and 15,602 of 1914; this J., 1915, 910.

Ores; Concentration of —. A. C. Howard, Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,203,341, Oct. 31, 1916. Date of appl., May 10, 1915.

SEE Eng. Pat. 5451 of 1915; this J., 1916, 895.

Sulphide ores; Separation of metallic —. F. J. Lyster, Broken Hill, N.S.W., Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,203,372, Oct. 31, 1916. Date of appl., May 8, 1913.

SEE Fr. Pat. 462,757 of 1913; this J., 1914, 320.

Ores; Concentration of —. F. J. Lyster, Broken Hill, N.S.W., Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,203,373, Oct. 31, 1916. Date of appl., July 14, 1915.

SEE Fr. Pat. 460,677 of 1914; this J., 1915, 35.

Furnaces. Eng. Pat. 101,757. See I. E 2



# **XI.—ELECTRO-CHEMISTRY.**

## **PATENTS.**

*Electrolytic apparatus for laundry and other hygienic purposes.* E. Reuss, Leeds, and V. Roberts, Rawdon, Yorks. Eng. Pat. 101,820, Feb. 3, 1916. (Appl. No. 1628 of 1916.)

THE apparatus is intended especially for use on board ship, and the electrolytic tank, with its supply tank and storage vessel, are suspended upon gimbals, or by a cross-bar and rods, or chains, or ropes, so that they may maintain their level position regardless of the motion of the ship. The electrolytic tank is provided with feed and delivery pipes on opposite sides, in addition to the ordinary nozzles, and the delivery pipe may be coiled upon a table from which the storage tank is suspended.—B. N.

*Electrolytic apparatus.* I. H. Levin, Newark, N.J. U.S. Pat. 1,199,472, Sept. 26, 1916. Date of appl., June 3, 1916.

SEVERAL bipolar electrodes are arranged to form a series of cells, with ducts, for feeding the electrolyte and taking off the gas, common to all the cells. A constriction is formed in the path of the electrolyte between adjoining electrodes by an insulating medium, whereby a resistance is created sufficient substantially to prevent the flow of the current from one electrode to another through the ducts.—B. N.

*Liquids; Apparatus for treating [electrolysing].* C. P. Landreth, Philadelphia, Pa. U.S. Pat. 1,301,202, Oct. 10, 1916. Date of appl., July 14, 1914. HORIZONTAL sets of electrodes are arranged in a vertical casing alternately with cleaning blades of insulating material which are mounted on a vertical shaft so as to be in contact with the electrodes. The shaft is rotated by an electric motor which also drives a dynamo in circuit with the electrodes.—W. F. F.

*Resistor; Electric.* W. S. Hadaway, jun., New York. U.S. Pat. 1,200,352, Oct. 3, 1916. Date of appl., Sept. 5, 1911.

A NICKEL-CHROMIUM wire is encased in a continuous tube of the same alloy, the wire being insulated from the tube by a filling of aluminium silicate. The wire and casing are flexible, so that the resistor may be bent into any desired shape, and is manufactured in comparatively long sections, and then severed into lengths as required. It may be mounted and supported in any suitable manner, regardless of the conducting or non-conducting properties of the support.—B. N.

*Separators for storage batteries; Treating.* F. Wright, Assignor to Wright Storage Battery Co., Poughkeepsie, N.Y. U.S. Pat. 1,200,682, Oct. 10, 1916. Date of appl., Jan. 9, 1914. Renewed Mar. 14, 1916.

WOOD strips, for use as separators in a lead storage battery, are saturated with dilute sulphuric acid by soaking them for several days, and are then assembled side by side between a pair of electrodes immersed in dilute sulphuric acid. An electric current is passed between the electrodes, to subject the strips to the purifying action of electrical osmosis, thus removing the objectionable impurities electrolytically, and rendering the strips porous, inert, and suitable for use in the battery.—B. N.

*Furnace; Electric.* (A) H. W. Gillett and J. M. Lohr, (B) H. W. Gillett, Ithaca, N.Y. U.S. Pats. (A) 1,201,224 and (B) 1,201,225, Oct. 10, 1916. Dates of appl., (A) Nov. 5, 1915, (B) Mar. 11, 1916.

(A) An electric arc furnace is formed of a shell enclosing a cylindrical, refractory, retaining hearth,

built up of layers in which the heat-insulating power of each layer is greater than the next inner layer. The shell and hearth may be revolved by mechanical means on its horizontal axis, in one direction to a fixed point, and then in the reverse direction, to another fixed point. Electrodes, adjustable laterally and revolving with the body of the furnace, are introduced through the ends of the furnace, and are cooled by air, the supports for the means of adjustment and the cooling arrangements being electrically insulated from the shell. The body of the furnace is provided with an opening as a combined charging door and pouring spout, and provision is made for tightly closing it. (B) The cylindrical refractory hearth and the adjustable electrodes are mounted to rotate or oscillate about the regular axis of the hearth, and also to oscillate in endwise fashion about a horizontal axis substantially perpendicular to the regular axis, so that the latter describes a portion of a double cone.—B. N.

*Cathode for electrolytic cells.* F. G. Wheeler, Appleton, Wis., U.S.A. Eng. Pat. 15,759, Nov. 8, 1915. Under Int. Conv., Jan. 25, 1916.

SEE U.S. Pat. 1,152,772 of 1915; this J., 1915, 1060.

*Electric furnace [for treatment of gases].* I. Mosicki, Lemberg, Austria-Hungary. U.S. Pat. 1,201,607, Oct. 17, 1916. Date of appl., May 29, 1913.

SEE FR. Pat. 458,636 of 1913; this J., 1913, 1076.

*Electric furnace.* E. K. Scott, Belvedere, Assignor to Atmospheric Nitrates (Kilburn Scott Patents), Ltd., Manchester. U.S. Pat. 1,203,276, Oct. 31, 1916. Date of appl., Feb. 25, 1916.

SEE Eng. Pat. 3953 of 1915; this J., 1916, 476.

*[Electrolytic] process for producing jelly.* U.S. Pat. 1,199,467. See XIXA.

*Method and apparatus for sterilising [water].* U.S. Pat. 1,200,105. See XIXA.

## **XII.—FATS; OILS; WAXES.**

*Vegetable and animal oils; Storage changes in.* H. A. Gardner. J. Ind. Eng. Chem., 1916, 8, 997—998. (See also this J., 1912, 1041; 1914, 603.)

THE effects of prolonged storage on a number of vegetable and animal oils are tabulated. In nearly all cases the saponification value, acid value, and specific gravity increased, and the iodine value and refractive index decreased. Lithographic linseed oil and lumbang oil, however, showed increased iodine values. The changes were less in oils which had been previously sterilised. Free acid formed rapidly in linseed oil emulsions.—A. B.

*Beeswax and its adulterants; The viscosity of.* U. Fabris. Staz. sperim. agrar. ital., 1916, 48, 595—603. Bull. Agric. Intell., 1916, 7, 881.

THE viscosity index of beeswax, virgin and bleached, and of the chief substances used for its adulteration, was determined by comparing the rate of flow with that of nitrobenzene from a viscosimeter. The results showed great differences between the indices of the wax and of its adulterants, and the method is recommended for analytical use. The following figures represent the maximal and minimal values of the viscosity indices of the substances investigated: virgin beeswax 16.30, 15.23; white wax 17.53, 16.54; carnauba wax 43.03, 42.03; Japanese wax 21.42, 20.71; tallow 13.05, 12.39; stearin 8.50, 8.31; spermaceti 7.42, 6.74; paraffin and ceresin 6.09, 3.48.—E. H. T.

*Linseed and Chinese wood oils; Polymerisation of* —. Krumbhaar. Chem.-Zeit., 1916, 40, 937—938.

SAMPLES of linseed and Chinese wood oils were heated at 200°, 280°, and 300° C. in a large closed vessel through which was passed a slow current of carbon dioxide. The effect of heating on the characters of the two oils was as follows:—

Temperature, ° C.	Duration of heating.	Acid value.	Saponif. value.	Viscosity (Engler) at 25° C. Linseed oil = 1.	Iodine value.	Refractive index at 25° C.	Sp.gr. at 25° C.
<i>Linseed Oil.</i>	hours.						
200	20	1.1	194.5	1.00	175.0	1.473	0.921
200	40	2.6	193.0	1.13	168.7	1.480	0.926
280	15	3.4	194.8	1.35	160.1	1.482	0.929
280	30	5.8	192.0	2.35	145.6	1.486	0.933
300	10	7.4	191.1	7.96	108.0	1.489	0.946
300	20	17.8	193.1	115.00	120.4	1.492	0.961
		40.0	191.2	—	76.3	1.496	0.970
<i>Chinese Wood Oil.</i>	—						
200	2	2.0	193.2	2.5	160.3	1.515	0.942
200	4	1.0	191.8	4.0	149.7	1.468	0.940
	mins.	1.9	190.1	80.5	134.5	1.446	0.964
280	10	1.9	190.5	4.5	156.8	1.511	0.946
280	20	1.9	189.1	112.0	145	1.504	0.957
300	5						

gelatinised, with rise of temperature and decomposition.

The acid value of linseed oil showed no appreciable increase in the periods of heating given to the Chinese wood oil. The viscosity at 300° C. became so pronounced that the oil would not run from the viscometer, but there was still no gelatinisation. This was attributed to the formation of free acids, which also appeared to be the cause of the different mode of alteration of the refractive indices of the two oils. The different behaviour of the oils on heating is therefore one of degree rather than of kind, and there is no ground for regarding the polymerisation process of linseed oil as essentially different from that of Chinese wood oil. These experiments support Wolff's theory of polymerisation (this J., 1913, 496).—C. A. M.

#### PATENTS.

*Oils and the like; Apparatus for extracting* —. E. O. Barstow and T. Griswold, jun., Midland, Mich. U.S. Pat. 1,199,861, Oct. 3, 1916. Date of appl., Dec. 24, 1914.

THE apparatus consists of a closed chamber containing a rotary filter with a cylindrical filtering surface. The oil is supplied from relatively fixed sources to successive spaced portions of the filtering surface, while suction is separately applied to each area in turn.—C. A. M.

*Lubricating grease; Manufacture of* —. R. Hilsberg, Troisdorf, Germany. U.S. Pat. 1,200,617, Oct. 10, 1916. Date of appl., Nov. 12, 1913.

COMPOUNDS of oil acids or fatty acids with alkaline earths are mixed with mineral oil, and the mixture boiled, by means of superheated steam or otherwise, at about 150° C. at a pressure of about 5 atmos.—C. A. M.

*Oils; Bleaching of* —. G. F. Drohn, Omaha, Nebr. U.S. Pat. 1,200,713, Oct. 10, 1916. Date of appl., Jan. 5, 1915.

A BLEACHING agent is prepared by impregnating comminuted charcoal with a solution of an alkali hydroxide, drying the product at a temperature ranging from 100° C. to dull red heat, and grinding the residue to a fine powder.—C. A. M.

*Wool-grease; Method of refining* —. J. O. Handy and R. M. Isham, Assignors to Pittsburgh Testing Laboratory, Pittsburgh, Pa. U.S. Pat. 1,201,042, Oct. 10, 1916. Date of appl., Apr. 22, 1916.

THE free fatty acids in the grease are saponified and the soap separated from the unsaponified grease, petroleum spirit being added to prevent

emulsification. Subsequently the grease is washed free from soap by means of an aqueous liquid such as a weak solution of salt.—C. A. M.

*Drying-oil and process of making same*. H. Rebs, Düsseldorf, Germany. U.S. Pat. 1,201,625, Oct. 17, 1916. Date of appl., June 24, 1916.

THICKENED vegetable oil is mixed with a preponderating quantity of a mineral oil, free from paraffin, and boiling at about 300° C., or the vegetable oil may be mixed with the mineral oil and then thickened.—E. W. L.

*Emulsions; Process for making — and products thereof*. H. H. Hurt, Assignor to Robeson Process Co., New York. U.S. Pat. 1,201,301, Oct. 17, 1916. Date of appl., Jan. 27, 1916.

PERMANENT emulsions are obtained by thoroughly intermingling sulphite waste liquor preparations, either dried or not, with oils, such as drying oils, (e.g., linseed oil), and then adding a small amount of caustic soda.—E. W. L.

#### XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

*Acid values of boiled oils and varnishes; Errors in the determination of* —. E. E. Ware and R. E. Christman. J. Ind. Eng. Chem., 1916, 8, 996—997.

THE lead, manganese, cobalt, and zinc soaps of linseed oil are hydrolysed almost completely under the conditions existing during the determination of the acid value, and the same is true of the corresponding resins. The error thus introduced in the determination of the acid value of boiled oils is, in many cases, not serious, as only a small quantity of metallic soap is present, but in the case of varnishes, where considerable quantities of metallic soaps or salts of resin acids may be present, the results obtained by the usual method cannot represent the true acid value of the oil vehicle.—A. S.

*Method of measuring the viscosity of very viscous substances*. Feild. See XXIII.

## PATENTS.

*Pigment and paint; Zinc-containing* — O. W. Pickering, Springfield, Mass., Assignor to Pickering Paint and Pigment Co. U.S. Pat. 1,201,093, Oct. 10, 1916. Date of appl., June 2, 1916.

A PIGMENT composed of flocculent zinc aluminate is incorporated with a drying oil; with or without a drier.—C. A. M.

*[Printers'] ink, and process of making same*. E. G. Acheson, New York. U.S. Pat. 1,201,994, Oct. 17, 1916. Date of appl., May 23, 1916.

AN amorphous pigment, e.g. carbon, is partially deflocculated in presence of water, and the deflocculated and non-deflocculated particles are transferred to an ink vehicle, to produce a composition suitable for use as a printers' ink.—E. W. L.

*Phenol and formaldehyde; Process for the manufacture of hollow shapes from* — F. Pollak, Vienna. Eng. Pat. 14,490, Oct. 13, 1915.

THE mixture of raw materials, or an intermediate product thereof, is centrifuged in a heated mould rotating around its own axis until a hard infusible condensation product has been formed.—C. A. M.

*Coating composition*. W. B. Jones, Perth Amboy, N.J., Assignor to General Bakelite Co., New York. U.S. Pat. 1,200,731, Oct. 10, 1916. Date of appl., Nov. 5, 1915.

THE composition consists of a phenolic condensation product transformable by heat into an infusible substance, and a solvent therefor containing aniline in a proportion at least equal to that of the condensation product, with or without a cyclic hydrocarbon (xylene).—C. A. M.

*Resinous emulsion for sizing paper*. Eng. Pat. 17,576. See V.

*Drying-oil and process of making same*. U.S. Pat. 1,201,625. See XII.

## XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

*Export of rubber solutions containing coal tar products*.

THE Director of the War Trade Department draws the attention of manufacturers and exporters of rubber solutions to the fact that the export of such solutions as contain coal tar products and derivatives is prohibited to all destinations, except under licence from that department. The War Trade Department will not be prepared to consider applications for licences to export such solutions containing any considerable percentage of benzol. Manufacturers are accordingly advised to put themselves in touch with the Department of Explosives Supplies, Ministry of Munitions of War, Storey's Gate, S.W., with a view to ascertaining the nature of the substitute for benzol which should in future be employed in the manufacture of rubber solutions.

*Rubber testing at the Central Rubber Station at Buitenzorg (Java)*. O. de Vries. India Rubber J., 1916, 52, 717—719.

VULCANISATION tests are made of the rubber produced by the various estates which are members of the Station. Wide differences are found to exist between individual estates as regards the uniformity of their products; in some cases the curves for successive samples are nearly coincident; in others great differences in rate of cure are shown. The samples were cured with 7½%

of sulphur at 148° C., and curves are given showing the relation between such samples and others cured with 5% and 10% respectively of sulphur. The 7½% mixings required nearly 1½ times as long a cure as the 10% mixings. In agreement with Spence's temperature coefficient of 2.67 (per 10° C.), the author finds that the cure is nearly twice as long at 140° C. as at 148° C.—E. W. L.

*Vulcanisation tests; Ceylon* — Bull. Dep. Agric., Ceylon, No. 23. India-Rubber J., 1916, 52, 720—721.

THE investigation was concerned with the effect upon tensile strength, elongation, and rate of cure, of a number of factors in the preparation of plantation rubber. *Tensile strength*. Little effect was produced by varying the acid used in coagulation (acetic, 0.13 grm.; formic, 0.07 grm.; sulphuric, 0.10 grm.; hydrofluoric, 0.04 grm. per 100 c.c. of undiluted latex; or double these amounts); or by the addition of ammonia (0.0056%), sodium sulphite (0.2%), or formaldehyde (0.5%) to the latex before coagulation; nor was there any notable difference between hand-made and machine-made sheet. Thick crêpe gave slightly better figures than thin, and sheet gave better results than crêpe. Spontaneously coagulated rubber gave very good values; scrap from the trees gave very low results. The maximum strength of 64 samples was 2571 lb., the minimum 1607 lb. Two samples of fine hard Para gave respectively 2276 and 2312 lb. *Elongation*. Maximum, 919; minimum, 787%. Fine hard Para 893 and 880%. None of the factors had any very marked or constant effect. *Rate of cure* (rubber, 90; sulphur, 10%). Hand-made sheet cured quicker than machine-made; thick crêpe cured quicker than thin; sheet cured quicker than thin crêpe. In the smaller quantities given above, the nature of the acid had little effect on the rate of cure; when the double quantities were used the sulphuric and hydrofluoric acid samples cured more slowly. Excess of formaldehyde lengthened the cure considerably; ammonia and sulphite had no constant effect. Results are also quoted which show that the effect of washing sheet rubber, upon the three properties dealt with above, is practically negligible.—E. W. L.

## PATENTS.

*Composition. [Rubber mixing]*. A. Nixon, Manchester. Eng. Pat. 16,883, Dec. 1, 1915.

A COMPOSITION for solid tyres and "mechanical" rubber goods consists of india-rubber (Congo), 17; lithopone, 25; sulphur, 2½; glycerin, ½; finely pulverised or ground stone (flint pebbles), 2½ parts.—E. W. L.

*Vulcanisation of natural or artificial caoutchouc or caoutchouc-like substances; Process for accelerating* — S. J. Peachey, Manchester. Eng. Pat. 101,819, Feb. 3, 1916. (Appl. No. 1613 of 1916.)

VULCANISATION is accelerated by the addition to the mixing of nitrosophenol or its homologues. The time required to vulcanise a mixing consisting of rubber, 100, and sulphur, 10 parts, at 135°—145° C., is reduced from about 1 hour to about 30—35 minutes by the addition of 1 part of nitrosophenol.—E. W. L.

*Hard-rubber composition*. L. H. Baekeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pat. 1,200,692, Oct. 10, 1916. Date of appl., June 16, 1910.

A PLASTIC composition containing vulcanised rubber, with or without suitable filling materials, sulphur, and a condensation product of phenols and formaldehyde, is converted into hard-rubber (ebonite) by the action of heat.—E. W. L.

(A) *Vulcanised rubber; Agent for treating* —. (B) *Rubber product*. (C) *Process of reclaiming rubber*. (A) H. B. Cox, Bedford Hills, N.Y., Assignor to H. Goldman, New York. (B) and (C) H. B. Cox. U.S. Pats. 1,202,758, 1,202,759, and 1,202,760, Oct. 24, 1916. Dates of appl., (A) Jan. 16, 1913, (B) and (C) July 29, 1914.

VULCANISED rubber is reclaimed by treating it with a solution of rubber resin in a hydrocarbon, or/and with a solution of "vulcanised gum" in such a rubber-resin solution.—E. W. L.

*Fabrics used in conjunction with vulcanised india-rubber; Treatment of* —. W. E. Muntz, London. U.S. Pat. 1,203,241, Oct. 31, 1916. Date of appl., Feb. 19, 1914.

SEE Fr. Pat. 468,493 of 1914; this J., 1914, 974.

## XV.—LEATHER; BONE; HORN; GLUE.

*Myrobalans from Burmah*. U.S. Cons. Rep., Oct. 27, 1916.

THE chemical adviser to the Forest Research Institute, India, states that Burmese myrobalans or "pangia" fruits differ from Indian Chebulic myrobalans in composition and colour. In the air-dried Burmese material the tannin content was found to vary between 10 and 32%, averaging 20–25%, or about one-half that of Indian myrobalans. The non-tannin content ranged from 25 to 34%, averaging 27–30%, or about three times that of the Indian material. The colour is high. Tanning experiments with Burmese myrobalans gave a spongy and tough leather similar to that produced by the Indian myrobalans, and indicated that the Burmese product could be used in tanning butts for making army boots, etc., and for making black uppers of an inferior quality. They might also be used in conjunction with babul bark for making sole leather.

### PATENTS.

*Tanning materials; Manufacture of* —. Badische Anilin u. Soda Fabr. Ger. Pat. 291,457, Aug. 22, 1913. Addition to Ger. Pat. 262,558.

SALTS of hydroxysulphonic acids of the benzene or naphthalene series are heated, preferably under pressure, with formaldehyde or substances capable of yielding it. The reaction products are obtained in the form of salts. The free acids are soluble, amorphous or syrupy substances, nearly or quite colourless, which convert animal skin into a serviceable leather. The alkali salts of the acids are easily soluble in water, give colorations with ferric chloride, and do not precipitate gelatin in neutral solution.—A. S.

*Tanning*. E. Stiasny, Headingly, and O. Schmidt, Assignors to Badische Anilin und Soda Fabr., Ludwigshafen, Germany. U.S. Pat. 1,203,069, Oct. 31, 1916. Date of appl., Mar. 23, 1914.

SEE Addition of July 31, 1913, to Fr. Pat. 443,730 of 1912; this J., 1914, 209.

*Method and apparatus for drying [adhesive] liquids*. U.S. Pats. 1,200,116 and 1,200,117. See I.

*Treatment of spent tan bark, peat, and the like for use as fuel*. Eng. Pat. 101,730. See IIA.

*Process for the reclamation of bichromates [from spent tanning liquors]*. U.S. Pat. 1,201,392. See VII.

## XVI.—SOILS; FERTILISERS.

*Soils; Acidity and adsorption in — as measured by the hydrogen electrode* I. T. Sharp and D. R. Hoagland. J. Agric. Res., 1916, 7, 123–145.

USING a slightly modified form of the apparatus devised by Hildebrand (J. Amer. Chem. Soc., 1913, 35, 847–871), determinations of the H ion concentration in aqueous suspensions of many different soils were carried out, and they showed that in many cases the liquids were truly acid. The H ion concentration varied between  $0.2 \times 10^{-3}$  and  $0.2 \times 10^{-9}$ . Since the values found varied only very slightly when widely varying proportions of soil and water were used, it was inferred that the H ion concentration of the suspension was approximately the same as that of the corresponding soil solution. Soils containing calcium in equilibrium with the  $\text{HCO}_3$  ion and carbon dioxide gave a very slight alkaline reaction. The H ion concentration was not sensibly affected by alterations in the degree of fineness of the soil particles, but it was diminished when the soil had been heated previously. The lime requirement of a soil can be found by adding a standardised solution of calcium hydroxide to the soil suspension until a definite OH ion concentration is established. This electrometric titration method has yet to be developed, but that it is of value is shown by the fact that when calcium carbonate was added to different soil suspensions with an acid reaction in the amounts shown by the lime water titration to be necessary, approximately neutral liquids were obtained. The effect of adding the chloride of potassium, or sodium, or barium, to the soil suspension was to increase the acidity in each case nearly to the same extent, the barium salt producing a somewhat greater effect. The adsorption of OH ions by soil was also investigated. It was found that when 0.1 mgrm. of hydroxyl was added as  $\text{Ca}(\text{OH})_2$  to 50 c.c. of pure water, an OH ion concentration of  $3.8 \times 10^{-8}$  was produced; but in the presence of soil the same concentration could only be brought about by adding much greater quantities of alkalis. Investigating the action of soils on lime water, it was found that both positive and negative ions were removed simultaneously. The rival claims of the theories of adsorption, of base-exchange, and of the presence of free acids in soils are discussed in the light of recent researches, and the view is expressed that soil acidity is not necessarily related to ionic adsorption, but is fundamentally dependent on the equilibria of reactions yielding an excess of H ions.—E. H. T.

*Soils; The alkaline reaction produced by acids in —, viewed from the standpoint of plant nutrition*. G. Masoni. Staz. sperim. agrar. ital., 1916, 49, 132–149. Bull. Agric. Intell., 1916, 7, 799–800.

PREVIOUS investigation having shown that the presence of citric, malic, or tartaric acids in chalky soils, caused the retention of iron in solution in spite of the alkaline reaction they give rise to, experiments were undertaken to see if they exerted a similar action on manganese compounds. The results were affirmative and showed that only the hydroxy-acids were active in this respect, citric and malic acids proving particularly effective. Tests were also conducted with pure calcium carbonate and manganese compounds ( $\text{MnO}$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{MnO}_2$ , the carbonate, and the sulphate), and the results demonstrated the undoubted capacity of the lime to cause the retention of manganese in solution. In a third series of experiments common soils were mixed with manganese sulphate or the dioxide. With small amounts of sulphate (2 mgrms. per 50 grms. of soil) only citric and malic acids caused an increased quantity

of manganese to pass into solution, while for larger amounts (50 mgrms. per 50) any acid produced this effect. With manganese dioxide only citric and malic acids effected an increase in the amount of dissolved manganese. Thus, in presence of lime the compounds of manganese respond to treatment with acids in the same manner as those of iron. The *modus operandi* was to treat 25—50 grms. of the soil or prepared mixture with 50—100 c.c. of the acid in  $N/10$  concentration. After shaking and standing for about 8 hours until the alkaline reaction had developed, the material was filtered and the filtrate examined for manganese. —E. H. T.

*Lignoceric acid from rotten wood.* M. X. Sullivan. J. Ind. Eng. Chem., 1916, 8, 1027—1028.

From the products obtained by the dry distillation of rotten wood, a mixture of acids was isolated. After purification by means of the lithium salts, this was separated into two acids, melting respectively at 85° and at 78° C. (at 80°—82° C. after further purification). The latter acid was proved to be lignoceric acid, identical with that isolated by Schreiner and Shorey (this J., 1911, 40) from peat soil; and the former is probably inactive cerebronic acid. Sullivan (Science, 1913, 38, 678) has found cerebrosides in mould from soil, and Levene and West (J. Biol. Chem., 1913, 15, 193) have shown that lignoceric acid is an oxidation product of cerebronic acid derived from cerebrosides by hydrolysis. —A. S.

*Azotobacter; Experiments on the growth of —.* A. Cauda. Staz. sperim. agrar. ital., 1916, 49, 125—131. Bull. Agric. Intell., 1916, 7, 801—802.

SALTS of phosphoric acid favourably affect the growth of *azotobacter*, and when applied in amounts containing equal quantities of  $P_2O_5$ , the potassium salts are more effective than those of calcium. High proportions of nitrogenous compounds act detrimentally and prevent the formation of the typical film in impure cultures; low proportions restore the activity of the organism on a solid medium. Calcium carbonate is very beneficial, particularly when phosphoric acid is also present. Of the magnesium compounds, applied at the rate of 1%, the sulphate and magnesium sodium phosphate caused fermentation to begin sooner than the oxide; magnesium chloride had no action. *Azotobacter* develop well on agar-humus and their multiplication proceeds better in the presence of *Streptolix*, or of the blastomycetic form, than when alone. Different soils favour the activity to different extents; thus the organism is very active in compost and in tilled stubble soil; it is active in permanent rice-field soil and in irrigated meadow soil, but is nearly inactive in chalky vine soil and in the deeper layers of rice-field soil under rotation crops. *Azotobacter* flourish best in well-tilled soils containing humus and dressed with mineral fertilisers. —E. H. T.

*Plate method of counting bacteria; A comparison between agar and gelatin as media for the —.* [Bacteriological examination of soils.] H. J. Conn and W. D. Dotterer. New York Agric. Expt. Station, Tech. Bull. No. 53, 12—15, May, 1916.

A COMPARISON was made between soil-extract gelatin and asparaginate agar as plate media for counting the bacteria in soil (this J., 1915, 673). Dilutions of 1 in 100,000 and 1 in 200,000 were used. Each sample was plated in triplicate on each medium, and the plates were incubated at 18°—19° C. for one week in the case of gelatin and two weeks in the case of agar. The results showed that 38% of the plates of each medium gave counts which varied less than 5% from the

average, while 24% of the plates of each medium varied over 15% from the average. This agreement proves that the nature of the medium is not the cause of the widely different numbers which are sometimes obtained. —J. H. J.

*Phosphoric acid in soils; Method of extraction as affecting the determination of —.* H. Hale and W. L. Hartley. J. Ind. Eng. Chem., 1916, 8, 1028—1029.

COMPARATIVE experiments showed that with 2*N*-nitric acid (Brauer, this J., 1915, 42) as much phosphoric acid is extracted in 2 hours as in the official (American) method of extracting with hydrochloric acid of sp.gr. 1.115 for 16 hours. Moreover no interfering substances are extracted by the nitric acid, whereas a considerable quantity of organic matter is dissolved by the hydrochloric acid. —A. S.

*Phosphorites; Investigations into the utilisation of — in Russia.* A. V. Kasakov, N. P. Koblikov, V. N. Kotchetkov, K. N. Chvezov, and I. V. Jakuchin. Report by D. N. Priamichnikov. Agronomic Instit. of Moscow, 1915, 5, 1—100. Bull. Agric. Intell., 1916, 7, 804—807.

*Extraction of phosphoric acid from phosphorites.* Previous work had shown that practically all the combined phosphoric acid was extracted if the minerals were steeped in a given quantity of water prior to the treatment with sulphuric acid. In 1914, in investigating the influence of the shape and the speed of the agitator used in the acid treatment, Kasakov found that the Göttermann type of agitator was the best. Working with powdered phosphorites from Viatka, varying the acid concentration between 10 and 50%, and the speed of revolution between 300 and 1800 revolutions per minute, he found that the frothing, due chiefly to the escape of carbon dioxide, diminished as the speed increased; that there was an optimum speed at which all frothing ceased and the reaction reached its maximum energy; and that this speed could be determined with ease. Further, the method employed for mixing the materials has a marked influence upon the reaction; and the extraction is incomplete when the speed of rotation is insufficient, or if acid of 40% concentration or more be employed. Working on the same material, Kotchetkov and Koblikov found that the extraction could be increased from 73.77 to 95.67% by steeping the mineral in water, treating with the acid at 30° C., and then stirring the mass continuously throughout the whole period (10 mins.) of the reaction. In the investigation of the precipitation of phosphoric acid solutions by gypsum, Chvezov discovered that in addition to being influenced by the state of fineness of the solid, the speed of the reaction is increased when the amount of base present is augmented; but in this case the phosphoric acid of the precipitate—both total and citric-soluble—is diminished. Raising the temperature also decreases the solubility of the product in ammonium citrate. With the object of discovering a method of obtaining dicalcium phosphate more simple than that of precipitation, Kasakov treated degelatinised and degreased bones with aqueous solutions of phosphoric acid, and of sulphuric acid, both in varying concentrations. He obtained fair yields of phosphates with a solubility up to 91% in alkaline ammonium citrate, but similar experiments on phosphorites gave only negative results.

*Cultivation trials with phosphates and phosphorites.* To compare the fertilising effects of precipitated phosphate and superphosphate, Jakuchin grew millet and sugar-beets in black soil from South Russia, using as dressings superphosphate (15%  $P_2O_5$ ), basic slag (16%  $P_2O_5$ ), Palmer's precipitated dicalcium phosphate (37.94%

$P_2O_5$ ), and a precipitated phosphate containing 40%  $P_2O_5$ . The results obtained with the precipitated phosphates were as good as, and in some cases superior to, those obtained with superphosphate. The cultivation tests with phosphorites showed that some phosphates from the province of Saratov are partly assimilable by cereals.—E. H. T.

## PATENTS.

*Fertilising [tobacco plants]; Process of* — C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,200,806, Oct. 10, 1916. Date of appl., Sept. 4, 1914.

THE use of urea nitrate as a fertiliser for tobacco plants is claimed as producing a tobacco particularly free from obnoxious ash constituents and from marks on the dried leaves.—E. W. L.

*[Calcium] cyanamide; Process of granulating pulverulent products such as* — J. Roussel. Fr. Pat. 478,832, Feb. 22, 1915. Under Int. Conv., Mar. 24, 1914.

POWDERED cyanamide is mixed with, say, 5% of a powdered agglutinating agent, such as clay, marl, or kaolin, with the optional addition of casein (0.25%), and the mixture treated, whilst stirring, with a fine spray of water.—F. SODX.

## XVII.—SUGARS; STARCHES; GUMS.

*Glucose; Chemical composition of commercial [liquid] — and its digestibility.* J. A. Wesener and G. L. Teller. J. Ind. Eng. Chem., 1916, 8, 1009—1020.

THE results of a large number of experiments on the fermentation of solutions of liquid glucose (starch syrup) are given. The proportions of maltose and dextrose in two samples of commercial glucose, as calculated from the cupric-reducing power and the yield of carbon dioxide on fermentation, were 11.7 and 17.2% of dextrose and 22.9 and 16.4% of maltose. There were also present difficultly fermentable reducing substances amounting to about 14% calculated as maltose or 8% calculated as dextrose, and unfermentable dextrins amounting to about 47%. The two last-named classes of substances can be rendered fermentable by hydrolysis with hydrochloric acid or with Takadiastase or pancreatin, or, less readily, with cold water malt extract, and appear to be normal intermediate products in the transformation of starch to dextrose by the action of acids or enzymes. There is no justification for the claim that commercial glucose contains unfermentable reducing substances which are reversion products formed by the action of acid on dextrose at a high temperature. It is concluded that commercial glucose consists of products which are wholly assimilable as food.—A. S.

*Sugar factory effluents; Effects of the beet-saponin in* — F. Schulz. Böhm. Zeits. Zuckerind., 1916, 41, 4. Chem.-Zeit., 1916, 40, Rep., 374.

THE acid beet-saponin discovered by Kobert (this J., 1914, 937) is present in the effluents from the slicing machines and to a small extent in the diffusion water. It occurs in the form of calcium or magnesium salt in colloidal solution and can be separated almost completely by acidifying with a mineral acid. An injurious action on fish is to be observed only when the effluent from the slicing machines amounts to from 5—10% of the total effluent, or if the total effluent contains more than 5 mgrms. of the saponin per litre. Such a concentration is hardly ever attained in practice. The saponin, at the concentration mentioned, can be readily detected by the naphthoresorcinol test.—A. S.

*Polarimetric determination of sugar [sucrose] in condensed milk.* Brooks. Sec XIXA.

## PATENTS.

*Sugar juices; Process of treating* — H. Wiese. Wallaceburg, Ontario. U.S. Pat. 1,200,787, Oct. 10, 1916. Date of appl., Oct. 25, 1912.

SUGAR juice is treated with finely powdered calcium carbonate, heated to 70°—100° C., and filtered, then treated with a relatively small quantity of lime to destroy the glucose, carbonated, reheated, and filtered.—J. H. L.

*Saccharine juice; Process of refining* — E. J. Ruckstuhl, Levert, La. U.S. Pat. 1,201,104, Oct. 10, 1916. Date of appl., Aug. 21, 1913.

THE juice is forced at a high velocity into the upper part of a closed vessel, and compressed air is also injected into the upper part of the vessel and into the juice as it enters, so that foam is formed on the juice in the vessel. The foam, with the substances in it, is conducted from the upper part of the vessel.—J. H. L.

*Filter-press, especially for filtering sugar juices and the like.* E. Lehne, Klein Wanzleben. Ger. Pat. 294,310, Jan. 30, 1916. Addition to Ger. Pat. 291,316 (this J., 1916, 648).

THE end plates of the filter-press are connected below by a fixed longitudinal connecting piece, on which the filter elements rest, and above by a removable connecting piece. One of the end plates is hollow and communicates with a channel formed in the lower connecting piece, into which the outlet passages from the filter elements discharge. The filtrate flows from the channel through the hollow end plate and is discharged through one of the hollow trunnions on which the press is mounted.—A. S.

*Milk-sugar; Process of extracting — from whey.* J. G. Dietrich, McMinnville, Oreg. U.S. Pat. 1,201,027, Oct. 10, 1916. Date of appl., Feb. 26, 1916.

WHEY is heated under pressure in absence of air, to coagulate non-sugar matters, then cooled to 60° F. (15.5° C.) or below, to retard bacterial growth, and filtered. The filtrate may be concentrated *in vacuo*, and pasteurised in hermetically closed receptacles.—J. H. L.

*Exhausting materials in distilleries, sugar plants, and the like; Apparatus for* — V. Raisin, Paris. U.S. Pat. 1,201,344, Oct. 17, 1914. Date of appl., May 7, 1913.

SEE Fr. Pat. 445,976 of 1912; this J., 1913, 156.

## XVIII.—FERMENTATION INDUSTRIES.

*Permeability; Selective —: Absorption of phenol and other solutions by the seeds of Hordeum vulgare.* A. J. Brown and F. Tinker. Proc. Roy. Soc., 1916, B, 89, 373—379. (See also this J., 1912, 1149.)

WHEN barley seeds were steeped for 2 days in aqueous solutions of aniline or phenol, the liquid entering the seeds contained in all cases about three times as much of the solute as the steeping solution, though the latter was in some cases nearly saturated. In similar experiments with aqueous acetic acid, as the concentration of the acid in the steeping solution was increased from 0 to 100%, its concentration in the absorbed liquid increased to a maximum of 80% (for a steeping solution of 50%) and remained constant at this value for all higher concentrations of the steeping solution, except for anhydrous acid, which was not absorbed at all. The weight of

liquid taken up by barley seeds in any solution, when equilibrium has been attained, is less than, equal to, or greater than the weight which would be taken up in pure water, according as the concentration of the solute in the absorbed liquid is less than, equal to, or greater than that in the steeping solution. This is readily explicable on grounds of osmotic pressure. Comparison of data for a number of solutes reveals a close parallelism between the surface tension of their solutions and their capacity for entering the seeds. Gibbs' rule connecting surface tension and adsorption appears, therefore, to apply to the absorption of solutions by barley seeds, and the authors suggest that the selective permeability of the seed membrane is due to selective adsorption, a hypothesis which has been advanced on other grounds for membranes of the copper ferrocyanide type (see Tinker, this J, 1916, 657).—J. H. L.

*Fermentation; Influence of phosphates on alcoholic — at different OH-concentrations.* H. Euler and T. Tholin. Z. physiol. Chem., 1916, 97, 269—278.

FIFTY c.c. of 5% dextrose solution was fermented for 150 mins. at 20° C. by 0.5 gm. of a bottom-fermentation yeast, and maintained neutral to phenolphthalein ( $p_H$  = about 8) throughout this time by frequent additions of N/2 sodium hydroxide. Under these conditions, and also when dried yeast was used in place of living yeast, added phosphates produced a retardation and not an acceleration of fermentation (cp. Harden and Young, this J., 1908, 870; 1909, 1157; 1912, 553). For example, addition of 0.5, 1.0, 2.5, and 5.0% of phosphate ( $K_2HPO_4$ ) caused reductions of 12, 22, 39, and 50% respectively in the amount of carbon dioxide produced (i.e., evolved, or fixed by the alkali). When, on the other hand, the fermenting liquid was maintained slightly acid ( $p_H$  = 4.5), addition of 2.5% of phosphate accelerated the fermentation by 40%. In sugar solutions containing yeast and added phosphates in presence of toluene, no accumulation of hexosephosphate takes place if the solutions are maintained neutral to phenolphthalein.—J. H. L.

*Enzymes; Composition and formation of —. XII.* H. Euler and E. Löwenhamm. Z. physiol. Chem., 1916, 97, 279—290. (See also this J., 1911, 379, 973; 1912, 833.)

THE rate of fermentation of sodium pyruvate by a bottom-fermentation brewery yeast, in solutions containing monosodium phosphate to maintain a constant reaction, was found to be increased, in some cases three- or four-fold, by the presence of toluene or chloroform. After the yeast had been dried at ordinary temperatures, to a moisture-content of less than 10%, its fermentative power towards pyruvate was 60—90% of its former value (both referred to dry substance), and was practically unaffected by toluene or chloroform; the fermenting power of the dried yeast towards dextrose was only one-tenth of that of the fresh yeast. Attempts to increase the carboxylase-content of the yeast by cultivation in sugared nutrient solutions were unsuccessful, but an increase of 20% was produced by cultivation in nutrient liquids containing sodium pyruvate, combined with aeration; the invertase content of the yeast was at the same time doubled, whilst the fermenting power towards dextrose was reduced by 10%.—J. H. L.

*Beer; Fate of hexoses in the production of —.* F. Schönfeld and H. Krumhaar. Woch. Brau., 1916, 33, 81—84, 145—147, 156—158.

IN the fermentation of brewery worts the hexoses are fermented more rapidly, in proportion to their concentration, than maltose, probably because

their smaller molecular magnitude enables them to diffuse more readily into the yeast cells. In worts made from malt alone, the hexoses, which commonly amount to about one-tenth of the total extract, are completely eliminated during the primary fermentation, whatever the type of yeast, and the beers normally remain free from hexoses during storage, for maltose is hydrolysed only within the yeast cells and the dextrose formed is probably at once fermented. The authors carried out fermentations of worts containing added dextrose, with top and bottom-fermentation yeasts, at the low temperatures customary in Germany, and determined as glucosazone the dextrose (hexoses) present at different stages. They conclude that in bottom fermentations complete elimination of dextrose during the primary fermentation is in general only attained when the amount initially present does not exceed 35—65% of the total extract, according to the character of the yeast. In top fermentations at low temperatures, the amounts of hexoses which can be eliminated are as a rule somewhat less, though they vary considerably with the character of the yeast. At higher temperatures (e.g., at room-temperature) the racial characters that distinguish different top-fermentation yeasts disappear in large measure, and all become capable of fermenting completely very large proportions of added sugar (no data are given relating to these conditions). The authors conclude further from the experiments, that if a wort is treated with sufficient dextrose to satisfy the fermenting power of the yeast, the maltose is scarcely or not at all attacked. The addition of sucrose to wort is considered to have substantially the same effect as that of dextrose, since the former is rapidly hydrolysed in presence of yeast, even of the most weakly attenuating types. The authors discuss the bearing of these results on the use of top-fermentation yeasts for the preparation of "sweet beers" and, on the other hand, of lager beers under German brewing conditions.—J. H. L.

*Top fermentation yeasts.* F. Schönfeld. Ver. deutscher Chem., Oct., 1916. Z. angew. Chem., 1916, 29, 390.

UNSATISFACTORY results are sometimes obtained with top fermentation yeast and this is due to the fact that certain classes of these yeasts possess an extremely low power of fermenting maltose. Yeasts rich in maltase are formed in worts containing much maltose, whilst worts poor in maltose yield yeasts containing little maltase; the quantity of zymase formed is in proportion to that of the maltase. Yeasts rich in maltase, however, in the presence of interfering substances such as large quantities of dextrins, proteins, etc., tend to lose their hydrolytic properties and give bad results.—W. P. S.

*Volatile organic compounds, especially essential oils, formed in the manufacture of sulphite-cellulose.* Kertész. See V.

*Chemical composition of commercial [liquid] glucose and its digestibility.* Wesener and Teller. See XVII.

*Influence of alcoholic concentration and temperature on the biochemical synthesis of a-methylgalactoside.* Aubry. See XX.

#### PATENTS.

*Yeast; Process of manufacturing —.* I. Lavedan. New Orleans, La. U.S. Pat. 1,201,062, Oct. 10, 1916. Date of appl., Feb. 12, 1916.

IN the propagation of yeast, the scum or froth containing the yeast is continuously skimmed off the fermenting liquid, and separated, e.g., by

centrifuging, into yeast and liquid, and the latter is continuously returned to the fermenting vessel. The yeast is aerated during propagation and separation from the scum.—J. H. L.

*Diastatic product; Apparatus for producing*—J. Takamine, New York. U.S. Pat. 1,201,385, Oct. 17, 1916. Date of appl., Jan. 28, 1913.

A HORIZONTAL rotary drum with projecting baffle-plates fixed longitudinally to its inner walls, has within it a fixed pipe disposed longitudinally and fitted with spraying nozzles, and also fixed conduits for admitting and withdrawing air. The spraying nozzles are directed towards the rising side of the drum, and the orifices of the air inlet and outlet conduits face the opposite side.—J. H. L.

*De-alcoholising liquors; Process for*—L. A. Rosenblatt, San Francisco, Cal. U.S. Pat. 1,201,873, Oct. 17, 1916. Date of appl., Mar. 22, 1916.

WINE or other liquid, heated to about 80° C., is de-alcoholised by the copious injection of steam at such a pressure that the amount of steam condensed in the liquid is sufficient to maintain the volume of the latter practically unchanged.—J. H. L.

*Composition fuel.* Eng. Pat. 101,813. See IIA.

*Yeast extract and process of manufacturing the same.* U.S. Pat. 1,200,011. See XIXa.

### XIXa.—FOODS.

*Bread; Determination and distribution of moisture in*—H. L. Wessling. J. Ind. Eng. Chem., 1916, 8, 1021—1022.

THE moisture content of a loaf does not diminish uniformly from the centre to the crust, but is fairly constant excepting near the crust. To ascertain the true moisture content of a loaf, the sample should consist of one-quarter of a loaf when the latter is covered on all sides by crust or of one-half when the loaf has been baked in contact with another loaf and hence is only partly covered by crust. The method recommended for the determination of the moisture is practically the same as the German method (Arb. Kaiserl. Gesundheitsamte, 1915, 48, 605). The sample is weighed as quickly as possible in a tared dish on a torsion balance, then heated at a temperature not exceeding 80° C. until practically dry, allowed to stand exposed to the air for a few hours, weighed, ground to a fine meal, and the remaining moisture determined on a 2-grm. sub-sample by drying in a vacuum oven at 100° C.—A. S.

*Agar plates; The number of colonies allowable on satisfactory*—[Bacteriological examination of milk.] R. S. Breed and W. D. Dotterer. New York Agric. Expt. Station. Tech. Bull. No. 53, 3—11, May, 1916.

MILK containing about a half million bacteria per c.c. was used as the liquid in which the organisms were to be counted. Dilutions of 1 in 100, 1 in 1000, and 1 in 10,000 were sown on agar plates in triplicate, and incubated at 20° C. for five days. Those plates which gave closely agreeing results were used to compute the average, and those plates which differed by more than 20% from the average were rejected. Altogether the colonies on 1435 plates were counted. The results showed that plates containing more than 30 and less than 400 colonies were in close agreement as to the final result. Plates having less than 20 and more than 400 colonies frequently departed widely from the average. The plates with too low counts gave high final results, owing probably to the greater effect of chance contamination with air organisms, while the plates with too high counts usually gave low final results, owing to colonies not developing

when overcrowded. Most of the plates were examined again after two days' incubation at 37° C., and the results obtained confirmed the preceding ones. Another series of experiments was made in which counts by the plate method were compared with counts by the microscope method. The plate counts averaged 4250 colonies per c.c., and the microscope counts of bacteria and clumps 5590 per c.c., a very close agreement for such widely different methods.—J. H. J.

*Sugar [sucrose] in condensed milk; Polarimetric determination of*—R. O. Brooks. J. Ind. Eng. Chem., 1916, 8, 1022—1024.

THE following method has given results in agreement with factory data, and has also proved accurate when tested with unsweetened condensed milk to which a definite quantity of pure sucrose has been added. 50 grms. of the sample is diluted to 100 c.c. and 26 c.c. (=13 grms. of sample) is diluted further to about 40 c.c., and Fehling's copper sulphate solution added, drop by drop, with stirring, until the proteins and fat are precipitated (about 1.5 c.c. is sufficient). The precipitate is filtered off and washed with water until the filtrate amounts to exactly 100 c.c. The polarimetric reading of the solution is taken in a 200 mm. tube. For the invert reading, 50 c.c. of the filtrate is mixed with 5 c.c. of concentrated hydrochloric acid, allowed to stand over-night, made exactly neutral to phenolphthalein with strong alkali solution, then acidulated with one drop of 10% hydrochloric acid, diluted to 100 c.c., filtered, and the polarimetric reading taken in a 200 mm. tube. The observed direct reading is multiplied by 2 and the observed invert reading by 4, and then the sucrose calculated by Clerget's formula, using the factor 141.7.—A. S.

*Butter; Effect of feeding on the composition of*—Decorticated ground nut cake and decorticated cotton cake. H. T. Cranfield. Analyst, 1916, 41, 336—339.

THE addition of decorticated ground nut cake to the rations of cows did not materially affect the composition of the butter fat obtained from the milk yielded by the animals, except that there was a slight increase in the proportion of unsaturated glycerides. This cake is more suitable for winter feeding as it tends to produce a soft butter, whilst cottonseed cake may be used in the summer since its use does not alter the composition of the butter fat. (See also this J., 1915, 1108; 1916, 938.)

—W. P. S.

*Palm kernel cake.* C. Crowther. J. Board Agric., 1916, 23, 734—749.

PALM kernel cake has been used to a small extent as a cattle food for some 60 years, but as it was considered to be indigestible, not very palatable to stock, and to deteriorate rapidly in storage, the extension of its use was precluded. An experimental investigation showed that the difficulty due to the unattractive flavour and aroma of the cake disappears if the cake is mixed with other foods in such amount that the cake does not exceed 50% of the mixture; addition of molasses, spices, etc., is useless for the purpose. The keeping qualities of palm kernel cake appeared to equal those of other kinds of cakes with the exception of linseed and soya cakes. Direct determination of the digestibility of palm kernel cake and extracted meal in an experiment with two sheep showed that these foods rank as the most digestible at the farmer's disposal; in this respect, the cake is worth 35%, and the meal 23%, more than Egyptian undecorticated cottonseed cake. Feeding experiments with five cows indicated that the use of the cake increased the fat-content of the



milk to a slight extent and had an appreciable influence on the composition of the butter-fat obtained from the milk; the saponif. value was increased by over 4 units, the iodine value decreased to a similar extent, the Reichert-Wollny value showed an increase of 0.5 to 1.7, and the Polenske value an increase of 0.26 to 0.57.

—W. P. S.

*Vitamines and lipoids in margarine and butter.*  
J. De Ruiter. J. Ind. Eng. Chem., 1916, 8, 1020—1021.

THE author determined "lipoids" by shaking with hydrochloric acid of sp.gr. 1.19, then separating the acid, diluting with water, filtering off the precipitated "lipoids," washing with acid water, and drying at 100° C. The substances thus extracted gave an ash rich in phosphorus. The content of "lipoids" in various substances, determined in this way, was as follows:—sesame oil, 0.1 gm. per 100 c.c.; arachis oil, olive oil, cold-liver oil, refined coconut oil, and filtered butter fat, traces; butter, 0.4; "klappa" ("vegetable butter"), 0.75; "planta" ("vegetable butter"), 0.475; margarine, 0.075 gm. per 100 c.c. Since Osborne and Mendel have shown that certain substances, apparently of lipid nature, are necessary in human food to maintain health and growth, attempts were made to increase the content of lipoids in "vegetable butter." Wheat bran was treated with dilute lime water for 24 hours, and the liquor then removed by pressing, shaken with a molten mixture of refined coconut oil and arachis oil, the emulsion mixed with one-fifth of its quantity of skim milk, allowed to ripen, and the fat separated, and worked up into "vegetable butter." The "bran butter" prepared in this way contains 1.125 grms. of lipoids per 100 c.c., and the liquor separated from the fat can be worked up into a kind of cheese containing a considerable proportion of the wheat albumins.—A. S.

*Sugar in meat products, particularly extracts; Determination of.*—W. B. Smith. J. Ind. Eng. Chem., 1916, 8, 1024—1027.

FOR the clarification of meat extracts previous to the determination of sugar by means of Fehling's solution, the most satisfactory results are obtained by use of an excess of picric and phosphotungstic acids, followed by a minimum of hydrochloric acid. In the case of meat, 50 grms. of the finely divided sample (fairly free from fat) is boiled with about 150 c.c. of water for 15 or 20 mins., cooled, treated with from 1 to 5 grms. of picric acid and 15—20 c.c. of 20% aqueous phosphotungstic acid, then made up to 250 c.c., exclusive of fat, and filtered. 150 c.c. of the filtrate is diluted to 160 c.c. with 8 c.c. of concentrated hydrochloric acid and 2 c.c. of water, filtered, and the reducing sugars are determined by Bertrand's method (this J., 1907, 60) in portions of the filtrate, before and after inversion; 20 c.c. of filtrate = 3.75 grms. of sample. In the case of meat extracts, 5 grms. is dissolved in 25 c.c. of water, the solution treated with 4—6 grms. of picric acid and 40—60 c.c. of 20% aqueous phosphotungstic acid, diluted to 100 c.c., and filtered; 60 c.c. of the filtrate is treated with 3 c.c. (or more, if necessary) of concentrated hydrochloric acid, made up to 66 c.c., filtered quickly, and the reducing sugars determined in the filtrate as above; 20 c.c. of filtrate = 0.909 gm. of sample. By this method the total reducing sugar may be determined within 0.1%, and reducing sugar in presence of sucrose within 0.1 or 0.2%.—A. S.

*Animal proteins; The phosphorus-content of*  
—after de-mineralisation. L. Lindet. Bull. Soc. Chim., 1916, 19, 395—399.

It has previously been shown in the case of

commercial casein that samples which have been coagulated by rennet and washed without acidification contain considerably more calcium and phosphoric acid than samples which have been precipitated by dilute acids, and it is evident that analyses of proteins containing phosphorus may lead to erroneous conclusions if no precautions have been taken to eliminate pre-existing mineral phosphates. The method employed by the author in the examination of animal proteins consists in extracting the matters soluble in water or dilute saline solutions, precipitating the soluble proteins by phenol in presence of 0.2% acetic acid, and collecting and drying the precipitate. This is decomposed by boiling sulphuric acid, the nitrogen determined in one aliquot portion and the calcium and phosphoric acid in the other after neutralisation with solid ammonium carbonate. The residue insoluble in water or salt solution is freed from fat by extraction with petroleum spirit, then exhausted with 0.2% acetic acid and decomposed with boiling sulphuric acid; the calcium and phosphoric acid are determined in this residue and calculated as percentages of the nitrogenous matter. Examined in this manner, the proteins of white of egg were found to contain no organic phosphorus. From the yolk of egg, after separating the fat and the vitellin, a protein was obtained resembling the protein of the white in that phosphorus was present only as calcium phosphate but differing in rotatory power. The purified vitellin, after exhaustion with fat-solvents and dilute acetic acid, contained phosphorus equivalent to 3.60—3.72%  $P_2O_5$ . The proteins of ox-blood contained no organic phosphorus; gelatin and ossein also contained only mineral phosphate. The soluble proteins of beef-fibre, liver, and brains were free from organic phosphorus but the insoluble proteins of beef showed 0.25%; calf's liver, 1.0; ox liver, 1.26; sheep's brain, 1.59, and ox-brain, 1.82%  $P_2O_5$  in organic combination, calculated on the total proteins. Of the flesh of fish, both the soluble and insoluble proteins contained only mineral phosphates.—J. F. B.

*Pectin gels; Consistence of.*—J. B. McNair. J. Phys. Chem., 1916, 20, 633—639.

PECTIN, acid (organic), and sugar are the principal factors in fruit jelly making; these three substances, independently or combined, increase the viscosity. Mixtures of any two or all three of the substances have viscosities greater than the sum of the individual viscosities. Jelly will form from a solution containing 3% of pectin and 65% of sugar. Besides increasing the viscosity, the sugar appears to act as a dehydrating agent. The pectin used in the experiments was obtained by boiling lemon rinds with alcohol, then heating the rinds with water at 110° C., filtering the aqueous extract, treating the filtrate with twice its volume of alcohol, collecting the precipitate, washing it with alcohol and ether, and drying it over sulphuric acid.

—W. P. S.

*Chemical composition of commercial [liquid] glucose and its digestibility.* Wesener and Teller. Ser. XVII.

#### PATENTS.

*Preserving meat and other food products; Process for.*—F. Penza, Marseilles, France. Eng. Pat. 101,824, Feb. 8, 1916. (Appl. No. 1838 of 1916.)

MILK is warmed to 35° C. and clotted, and the clot stirred vigorously until a flocculent precipitate is produced which is collected and consolidated to a paste. A cloth, dipped in the whey from the clot, is wrapped round the paste which is allowed to drain for a few days until it has become glutinous. It is then cut into shreds which are treated with

boiling water so as to obtain an elastic mass of hydrated casein. This plastic mass is used to form a coating round the meat to be preserved, which has been freed previously from pathogenic organisms.—J. H. J.

**Food products.** W. O. Snelling, Pittsburgh, Pa. U.S. Pat. 1,199,124, Sept. 26, 1916. Date of appl., Apr. 3, 1915.

A **STARCHY** food, such as potato, is subjected to the action of a hot oleaginous fluid, and is subsequently degreased by means of a solvent. Any solvent remaining in the product is removed by heating under reduced pressure.—J. H. J.

**Jelly; Process for producing** — J. S. Ellithorp, jun., Palatine Bridge, N.Y. U.S. Pat. 1,199,457, Sept. 26, 1916. Date of appl., June 12, 1916.

**FRUIT** or vegetable juice containing pectin, with added sugar, is subjected to the action of an electric current.—J. H. J.

**Yeast extract and process of manufacturing the same.** A. Nilson, Chicago, Ill. U.S. Pat. 1,200,011, Oct. 3, 1916. Date of appl., June 12, 1916.

**Yeast** is heated with dilute mineral acid (hydrochloric acid) below 100° C., to rupture the cells and extract their soluble constituents, and the extract is neutralised, e.g., with sodium carbonate.—J. H. J.

**Powdered-milk product.** S. A. Vasey, London. U.S. Pat. 1,202,130, Oct. 24, 1916. Date of appl., Mar. 25, 1916.

See Eng. Pats. 2772 and 7766 of 1915; this J., 1916, 649.

**Process of extracting milk-sugar from whey.** U.S. Pat. 1,201,027. See XVII.

## **XIXb.—WATER PURIFICATION; SANITATION.**

### **PATENTS.**

**Purifying liquids; Method and apparatus for** — C. L. Weil, Port Huron, Mich. U.S. Pat. 1,199,514, Sept. 26, 1916. Date of appl., Dec. 31, 1915.

A **LIQUID** containing dissolved impurities which can be precipitated by heating, is passed into the lower portion of a horizontal vessel containing vertical revolving arms. The vessel is closed and the air in the upper portion is kept highly heated. The arms carry up films of liquid into the heated atmosphere, and the impurities are precipitated on the arms. As the arms sink into the impure liquid again the film of purified liquid on them floats off on the surface of the colder liquid, and is removed while hot.—J. H. J.

**Sterilising [water]; Method and apparatus for** — C. F. Burgess, Madison, Wis. U.S. Pat. 1,200,165, Oct. 3, 1916. Date of appl., Oct. 30, 1913.

Two electrodes of a battery are held in contact with bibulous material containing sodium chloride. When the electrodes are placed in water, it is rendered locally conductive, and sodium hypochlorite is produced by the current; this diffuses through the water and acts as a sterilising agent.—J. H. J.

**Feed of chemicals or like substances to water or other fluids; Regulating and proportioning the** — Regulating and proportioning the feed of dry or granular chemicals in water-mains. G. G. Earl and A. B. Wood, New Orleans, La. U.S. Pats. (A) 1,200,324 and (B) 1,200,325, Oct. 3, 1916. Dates of appl., May 10, 1911, and May 3, 1916.

(A) The chemical in solution is fed into the main conduit from a completely filled vessel, the discharge from which is regulated by a partition

or diaphragm in the vessel, moving in accordance with the difference between the static and total pressures of the fluid in the main. The chemical solution is stored in a reservoir, the flow from which is controlled by a second similar vessel and partition as above. The two vessels are connected by a valve which acts in response to the movements of the two partitions. (B) In an apparatus of similar construction to that described above, a separate flow of fluid is used to convey the dry chemicals, and is regulated to be proportional to the flow in the water-main by means of a valve governed by the two pressures derived from both flows.—J. H. J.

**Softening and purifying water.** C. Massacriu, Berlin-Tempelhof, and A. Neumann, Reppen, Germany. U.S. Pat. 1,202,557, Oct. 24, 1916. Date of appl., Aug. 31, 1915.

THE water is filtered through a porous, amorphous material of igneous origin, which has been steamed and contains water of hydration and removable alkali; by this means dissolved calcium compounds are retained in the filter.—J. H. J.

**Sewage effluents; Method of accelerating the deposition of solids in** — R. P. Bolton, New York, Assignor to A. Williams and E. F. Tweedy. U.S. Pat. 1,202,474, Oct. 24, 1916. Date of appl., Nov. 25, 1914.

THE effluent is introduced into a vessel so as to expel all the air, the vessel is then closed and a pressure applied greater than that existing in the liquid. This pressure is removed suddenly, and the process is repeated until the suspended matter has been freed from gases and has settled.—J. H. J.

**Destructor furnaces and the like; Working and construction of** — E. C. R. Marks, London. From Maschinenbau-Anstalt Humboldt, Cöln-Kalk, Germany. Eng. Pat. 14,850, Oct. 20, 1915.

THE charging apparatus is situated above the furnace and consists of two spaced rollers rotating in opposite directions and capable of being shifted laterally so as to permit of the passage between them of bulky material. The refuse falls on to the back portion of the grate, and is pushed forward mechanically when required, the clinker already in the front part being pushed out through the opened door in front. The air supply is a forced draught from below the front part of the grate, and the air as it passes up through the hot clinker, is preheated before it passes to the back portion of the grate. The damper controlling the air supply is connected by means of a shaft and bevel gearing with the rollers of the charging chamber, and regulated by them. When clinker is being discharged, the damper is closed, and it is not opened again fully until the back part of the grate has received the full charge.—J. H. J.

**Water-purifier; Automatic electric** — G. E. Erickson, New York. U.S. Pat. 1,199,253, Sept. 26, 1916. Date of appl., Dec. 28, 1915.

**Method and apparatus for mixing liquids.** U.S. Pat. 1,202,421. See I.

**Process for the treatment of volcanic rocks.** U.S. Pat. 1,202,550. See VII.

## **XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.**

**Strychnine in *Nux vomica*; Determination of** — H. R. Jensen. Pharm. J., 1916, 97, 458–461.

A COMPARISON of the methods of separation of strychnine and brucine in *Nux vomica* by oxidising with nitric acid at 20° C. and at 50° C. (B.P. 1914) respectively, indicated that at the lower tempera-

ture the average of the gravimetric results for strychnine, which varied  $\pm 2.1\%$  among themselves, was  $10.3\%$  higher than at the higher temperature. In three well-established cases the results by the B.P. process were  $9.9\%$  to  $11.7\%$  too low for an extract and  $14.5\%$  to  $17.2\%$  too low for the powder as compared with those obtained by oxidising at the lower temperature. With mixtures of pure alkaloids oxidation with cold nitric acid gave a mean result of  $99.6\%$  (corr.) whilst oxidation with warm nitric acid gave a mean loss of  $3\%$ . In all cases the basic value of the alkaloidal residue, estimated by titration, using cochineal as indicator, was very low compared with the gravimetric result. This was found to be due to the contamination of the alkaloidal residue with either strychnine nitrate or a similar strychnine compound to an extent not under control. Hence an uncorrected gravimetric result may indicate a strychnine content  $1.1\%$  to  $6.2\%$  too high, the uncorrected volumetric result giving correspondingly greater errors too low. By combining the gravimetric-volumetric results the margin of error is reduced to  $\pm 2\%$ . On leaving the final chloroform solution of the alkaloid residue overnight, before distilling, particularly after oxidation with warm nitric acid, large white needle crystals of the contaminating substance, m.p. about  $305^\circ\text{C}$ ., separated out. These were sparingly soluble in chloroform and in the sodium sulphate-sodium nitrate solution obtained in the course of analysis, were devoid of basic properties and of optical activity, and were apparently a dimorphic form of strychnine nitrate.—T. C.

*Alkaloids of phenolic function (morphine and derivatives, cupreine, adrenaline, etc.); General reaction of vegetable or animal*—G. Denigès. Ann. Chim. Analyt., 1916, 21, 213—216.

ALKALOIDS containing phenolic hydroxyl groups resemble other phenols in producing a coloration with titanium dioxide dissolved in concentrated acids (cp. Hauser and Lewite, Ber., 1912, 45, 2480; Lenher and Crawford, this J., 1912, 956). The reagent is prepared by heating natural titanium dioxide (rutile) with concentrated sulphuric acid for some hours near the boiling point. A very small quantity dissolves, and after cooling and standing the clear liquid is decanted from the residue. The following colorations are produced on shaking some particles of the substances named, or a few drops of their solutions, with 2—3 c.c. of the reagent:—morphine, blood-red; apomorphine, reddish-violet; oxydimorphine, wine-red (intermediate in tint between the former two); cupreine, orange, resembling the colour of alkali bichromate solutions; hordenine and tyrosine, deep orange; adrenaline, reddish-brown (very sensitive test). Quinine (methylcupreine) and codeine (methylmorphine) do not react in the cold, but they may be demethylated by heating with the reagent. Proteins containing tyrosine give an orange coloration on warming gently.—J. H. L.

*Thalleioquin.* A. Christensen. Ber. deut. Pharm. Ges., 1916, 26, 247—261. (See also this J., 1915, 979.)

QUININE, monobromoquinine, and dehydroquinine, and substances such as quinine dichloride, and quinine oxychloride, derived from quinine by saturating the vinyl group, all produce the green colouring matter, thalleioquin, when chlorine water followed by ammonia is added to their slightly acid solutions, whilst 5-dichloro-6-ketocinchonine oxychloride, formed by the action of 3 mols. of chlorine on quinine, gives thalleioquin on addition of ammonia only. Thalleioquin on drying loses ammonia, leaving 5,6-diketocinchonine hydrochloride,  $\text{C}_{20}\text{H}_{19}\text{O}_2\text{N}_2\text{Cl}$ , and hence is a loose combination of this latter substance with ammonia.

5-Chloro-6-hydroxycinchonine oxychloride,  $\text{C}_{20}\text{H}_{19}\text{O}_2\text{N}_2\text{Cl}$ , obtained by the action of 2 mols. of chlorine on quinine, yields thalleioquin on treatment with any oxidising agent, a substance able to combine with chlorine, and ammonia, whilst 5-chloro-6-hydroxyquinoline (o-chloro-p-hydroxyquinoline) similarly treated yields thalleioquinoline.—T. C.

*$\alpha$ -Methylgalactoside; Influence of alcoholic concentration and temperature on the biochemical synthesis of*—A. Aubry. J. Pharm. Chim., 1916, 14, 289—294. (See this J., 1914, 272.)

THE maximum yield of methylgalactoside is obtained when the initial concentration of methyl alcohol in the reaction mixture is about 20—30 grms. per 100 c.c., and the temperature is kept near  $20^\circ\text{C}$ .; 65% of the galactose present is converted into galactoside in the course of a few months. With more concentrated alcohol, and at higher temperatures, the synthesising enzyme is destroyed fairly rapidly, though it is more stable than  $\alpha$ -glucosidase.—J. H. L.

*Saw palmetto, a phytochemical study of the fruit of Sabal serrulata.* C. A. Mann. Bull. Univ. Wisconsin, No. 767, 1915. Amer. J. Pharm., 1916, 88, 517—518.

THE so-called volatile oil obtained from the fruit (berries) of *Sabal serrulata* consists of a mixture of esters and fatty acids; the esters result from the condensation of free fatty acids naturally present in the fruit with ethyl alcohol formed by the fermentation of the sugars. Larger quantities of esters are formed when the fruits are preserved in alcohol. The fresh fruits yield a mere trace of volatile oil consisting of lower fatty acids and free from esters. Lipase is present in the fruits but plays no part in the formation of the esters.—W. P. S.

*Vanillin in vanilla extract; Determination of*—A. W. Dox and G. P. Plaisance. Amer. J. Pharm., 1916, 88, 481—484.

THE vanillin is precipitated by treating its hydrochloric acid solution with thiobarbituric acid which may be readily prepared from malonic ester and thiourea; the precipitate consists of 3-methoxy-4-hydroxybenzal-malonylthiourea. Twenty-five c.c. of the vanilla extract is de-alcoholised and then diluted to 50 c.c. with lead acetate solution; after standing for a few hours at  $37^\circ\text{C}$ ., the mixture is filtered, 40 c.c. of the filtrate is treated with a quantity of concentrated hydrochloric acid sufficient to make the volume up to 50 c.c. and the acidity 12%, the lead chloride is filtered off, and 40 c.c. of this filtrate is treated with thiobarbituric acid in 12% hydrochloric acid solution. The precipitate is collected after 18 hours, washed with 50 c.c. of 12% hydrochloric acid, then with 20 c.c. of water, dried at  $98^\circ\text{C}$ ., and weighed. The method cannot be applied to artificial extracts coloured with caramel, since the latter contains furfural derivatives, and thiobarbituric acid is a precipitant for all aromatic aldehydes. The presence of caramel is indicated by the brown colour of the filtrate after clarification with lead acetate; in the absence of caramel this filtrate is straw coloured. The acidified filtrate also yields a precipitate with phloroglucinol if it contains caramel.—W. P. S.

*$\beta$ -Santolinene; Constitution of*—L. Francesconi and N. Granata. Gaz. Chim. Ital., 1916, 46, II, 251—256.

THE hydroxylamino-derivative of  $\beta$ -santolinene (this J., 1915, 197) is best obtained by heating *Santolina chamaecyparissus* oil (this J., 1911, 1332; 1912, 202) with hydroxylamine hydrochloride in alcohol-ether solution in presence of sodium

bicarbonate, and isolating the hydroxylamino-derivative in the form of its crystalline oxalate, m.pt. 161° C. The free base melts at 63°–64° C., and gives a nitroso-derivative when oxidised with mercuric oxide. *β*-Santolinone has properties resembling those of pulegone; its behaviour with hydroxylamine hydrochloride and the properties of the hydroxylamino-derivative indicate that the ketone contains the grouping  $(CH_3)_2C:C.CO$ , and the authors conclude that it is probably a derivative of *m*-cymene.—A. S.

*Salol and acetanilide in a mixture of the two; Determination of — and of salol and phenacetin in their mixtures.* B. Salkover. Amer. J. Pharm., 1916, 88, 484–485.

THE method depends on the fact that whilst salol, acetanilide, and phenacetin are all very soluble in chloroform, only salol is readily soluble in petroleum spirit; 100 c.c. of petroleum spirit dissolves only 0.015 gm. of phenacetin and 0.022 gm. of acetanilide. A weighed quantity of the mixture is shaken in a stoppered flask for 30 minutes with a measured volume of chloroform, an aliquot portion of the solution is then filtered into a weighed flask, the chloroform is evaporated, and the residue dried at 60° C. to constant weight. This gives the amount of salol and acetanilide, or of salol and phenacetin present. Another portion of the sample is then treated similarly with petroleum spirit; the residue obtained in this case is dried at 50° C., and represents the salol, but the weight of the residue must be corrected for the solubility of acetanilide or phenacetin (see above) depending upon which of these substances is present in the mixture. The presence of talc, starch, gum acacia, gum tragacanth, etc., does not interfere with the method.—W. P. S.

*Arsenobenzene derivatives; Prevention of the injurious effects observed after the injection of —.* J. Danysz. Comptes rend., 1916, 163, 535–538.

IT has already been shown (this J., 1916, 1034) that the unpleasant symptoms which manifest themselves after from several minutes up to several hours after the injection of arsenobenzene derivatives are due to the formation of a precipitate in the capillaries in presence of many salts, particularly calcium phosphate. This precipitate is usually gradually dissolved owing to the formation or presence of certain bases in the blood derived from amino-acids, so that no eventual serious consequences occur. If a series of injections is made at intervals of 3 to 4 hours, the intolerance manifested after the first injection usually diminishes gradually with each subsequent injection, the amount of precipitate formed diminishing, so that each injection is prophylactic for the successive one. In certain cases, however, the toxic symptoms gradually increase with each successive injection so that serious complications arise, generally terminating fatally after 2 to 5 days, after convulsions and coma. The two forms of intolerance are of the same nature and differ only in degree. It is thus possible to determine the susceptibility of a patient to toxic after-effects of arsenobenzene derivatives by commencing with small injections and noting if the toxic symptoms decrease or increase with the second injection. In the latter case treatment must either be suspended or attempts made to immunise the patient by the injection of very small doses at intervals.—T. C.

*Russian belladonna.* Chem. and Drug., Dec. 2, 1916.

THE cultivation of belladonna in Russia has been carried on with success since 1914. The leaves gave 28.23% of extract, containing 2.11% of hyoscyamine, and the stems 20%, containing 1.62% of the alkaloid. The whole herb yielded

24.37% of extract, with 1.88% of hyoscyamine. The hyoscyamine extracted from the leaves had m.pt. 110°–111° C., and specific rotation +22.12°.

#### Montserrat bay oil.

AN experimental plot in Montserrat was planted with bay trees in 1908, and the gathering of leaves began in 1911, when the yield of leaves was about 14 lb.; it gradually increased to 19 lb. in 1912, 28½ lb. in 1913, and 39 lb. in 1914. There has also been an increase in the yields of oil, which was in 1912 16.7, in 1913 18.3, and in 1914 19.5 oz. per 100 lb. of leaves. There was no definite indication that a particular period of the year is most suitable for harvesting. The average quality of the oil has declined somewhat in recent years, as shown by the following figures:—

	1912.	1913.	1914.
Specific gravity .....	0.9484	0.9460	0.9342
Phenol content, % .....	55.5	56.2	57.5 ..

No change was observed in the phenol content of a sample of bay oil which had been kept for 2½ years, but there was a slight increase of specific gravity, probably due to the polymerisation of myrcene.

*The flame arc in chemical manufacture.* Mott and Bedford. See IIb.

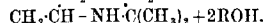
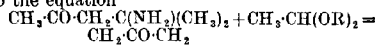
*Volatile organic compounds, especially essential oils, formed in the manufacture of sulphite-cellulose.* Kertész. See V.

*Application of the method of constant boiling-point mixtures to the qualitative analysis of mixed organic liquids.* Atkins. See XXIII.

#### PATENTS.

*Vinyldiacetoneamine and its salts; Manufacture of —.* A. T. King, F. A. Mason, and S. B. Schryver, London. Eng. Pat. 101,738, Jan. 26, 1916. (Appl. No. 1208 of 1916.)

THE interaction of an acetal of the type,  $CH_3.CH(OR)_2$ , with diacetoneamine or its salts, or with acetone saturated with ammonia, produces vinyldiacetoneamine or its salts according to the equation



Better yields (about 90% of the theoretical) are obtained in much shorter times than by previously published methods. In the examples given the oxalate is obtained by heating together diacetoneamine acid oxalate and diethyl-acetal in solution in normal butyl alcohol for 3 hrs. or in ethyl alcohol for 7 hrs.—B. V. S.

*2-Chloroisopentane; Process of producing —.* O. Graul, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,202,282, Oct. 24, 1916. Date of appl. Mar. 13, 1913.

A MIXTURE of petrol hydrocarbons, chiefly pentane and isopentane, is chlorinated, hydrogen chloride is split off from the separated monochloropentanes by a suitable reagent, and the olefines obtained are treated with hydrogen chloride. The 2-chloroisopentane thus formed is separated, the residue treated with an isomerising agent, and more 2-chloroisopentane produced by the action of hydrogen chloride. The processes of separation, isomerisation, and treatment with hydrogen chloride may be repeated until practically the whole of the olefine is converted into 2-chloroisopentane.—E. W. L.

*Tobacco* [; *Removing nicotine from* —]. W. Kraus, Berlin-Charlottenburg, Germany. U.S. Pat. 1,201,831, Oct. 17, 1916. Date of appl., Nov. 30, 1915.

SEE Eng. Pat. 2394 of 1915; this J., 1915, 852.

*Compounds containing carbon and hydrogen; Producing* —. A. Mittasch and C. Schneider, Assignors to Badische Anilin und Soda Fabr., Ludwigshafen, Germany. U.S. Pat. 1,201,850, Oct. 17, 1916. Date of appl., Feb. 11, 1914.

SEE Fr. Pat. 468,427 of 1914; this J., 1914, 984.

*Propylene; Production of* — from acetylene and methane. A. Heinemann, London. U.S. Pat. 1,202,385, Oct. 24, 1916. Date of appl., Mar. 16, 1915.

SEE Fr. Pat. 458,397 of 1913; this J., 1913, 1086.

*Vaccin culture and the like and the preparation thereof*. C. J. H. Nicolle, Tunis. U.S. Pat. 1,202,567, Oct. 24, 1916. Date of appl., Dec. 13, 1913.

SEE Eng. Pat. 28,535 of 1913; this J., 1914, 666.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Martens' density meter [polarisation photometer]; A modification of* —. E. Goldberg, Ver. deuts. Chemiker, Oct. 1916. Z. angew. Chem., 1916, 29, 394.

By inserting a small glow lamp under the photometer table in place of the reflecting prism and replacing the opal at the end of the illumination tube by white paper, the usual powerful lamp being of course dispensed with, a much stronger, and even illumination of the negative is obtained and densities as high as 3 can be read without difficulty.—B. V. S.

*Halation on photographic plates*. E. Goldberg, Ver. deuts. Chemiker, Oct., 1916. Z. angew. Chem., 1916, 29, 394.

In previous methods of determining tendency to halation the usual plan has been to measure the exposure necessary to produce a definite ring or halo round a point or line of light. The author measures the amount of fog produced in a protected part of the plate, surrounded by exposed parts. To avoid the necessity of giving exact exposures, an exposure is made simultaneously on the same plate through a neutral wedge, and the points in the wedge image corresponding with the other parts of the plate are determined. A table gives a comparison of the efficiency of various anti-halation plates and methods, and shows that a red backing between the sensitive film and the support is the most efficient.—B. V. S.

*The flame arc in chemical manufacture*. Mott and Bedford. See IIfb.

*Method for determining the strength of paper when wet*. Reed. See V.

### PATENTS.

*Photographic pictures; Process for making* — by the use of negatives formed on an opaque base. A. E. L. Hudson, Pontypidd, Glamorgan. Eng. Pat. 14,511, Oct. 14, 1915.

An opaque base such as white paper is used as the support for the sensitive coating for roll films. For plates the negative paper is mounted on stiff cardboard by use of a medium which dissolves in the developer. Printing from negatives taken on this paper is done by reflected light.—B. V. S.

*Photographs in natural colours; Production of* —. J. Szczepanik and F. Habrich, Dresden, Germany. Eng. Pat. 20,396, Sept. 9, 1913. Under Int. Conv., Sept. 9, 1912.

SEE Ger. Pat. 264,207 of 1912; this J., 1913, 1033.

## XXII.—EXPLOSIVES; MATCHES.

*Trinitrotoluene; Nitration of toluene to* —. I. W. Humphrey. J. Ind. Eng. Chem., 1916, 8, 998—999.

EXPERIMENTS on the nitration of mononitrotoluene under varying conditions showed that better yields of pure trinitrotoluene are obtained by nitrating at a somewhat lower temperature than prescribed by Langenscheidt (this J., 1912, 1147) and by using 98% sulphuric acid. A yield of 87.1% of the crude product, and 76% of crystallised trinitrotoluene of m.p. 80.3° C., was obtained by using for each part of mononitrotoluene 9.6 parts of a mixed acid composed of 82% of sulphuric acid, 16% of nitric acid, and 2% of water, the mixture being heated for 2½ hours at 120°—125° C. (See also Hoffman, this J., 1916, 655).—A. S.

*Nitro-explosives; Mixtures of* —. M. Giua. Gaz. Chim. Ital., 1916, 46, II., 272—277. (See also this J., 1915, 984.)

$\alpha$ -TRINITROTOLUENE and picric acid when melted together do not form a chemical compound. The eutectic mixture melts at 55° C., and contains about 34% of picric acid. Camphor, which diminishes the sensitiveness of many explosives, does not form a chemical compound when fused with  $\alpha$ -trinitrotoluene, at least up to a concentration of 80% of camphor; the eutectic mixture contains about 43% of camphor and melts at about 52° C.

The differences in the published statements as to the melting point of  $\alpha$ -trinitrotoluene (compare Rintoul, this J., 1915, 61) are ascribed to differences in the method of determination, especially in the rate of heating. It is urged that in specifications the exact conditions under which the melting point is to be determined should be stated. It would probably be more satisfactory to use the determination of the solidifying point instead of the melting point as a test of purity.—A. S.

### PATENTS.

*Explosives*. Perchlorate Safety Explosives, Ltd., and F. G. L. Johnson, London. Eng. Pats. 14,866, Oct. 20, 1915, and 1480, Jan. 31, 1916.

AMMONIUM perchlorate is incorporated with resin (4 to 8%, or 16%) in a finely divided condition or dissolved in a suitable solvent. Part of the ammonium perchlorate may be replaced by potassium perchlorate, and mineral oil or wax and zinc or aluminium powder may also be introduced in approximately equal proportions.—C. A. M.

*Detonators* [; *Damp-proof* —] and method of preparing the same. E. Burkard, Cologne, Germany. Eng. Pat. 16,405, July 9, 1914.

THE detonator is charged as usual with a suitable nitro compound and a priming such as mercury fulminate, lead azide, etc., and is then protected from damp or other atmospheric influences by means of an unperforated covering cap, upon which is placed an easily ignitable priming material not readily affected by the atmosphere and in sufficient quantity to perforate the inner cap. If necessary, this small charge is protected by a perforated cap. As an alternative, a small detonator or percussion cap is introduced into the closed cap to start the detonation.—C. A. M.

**Nitroglycerin:** Process for separating — from acid mixtures containing the same. A. Hough, Chisley, Quebec, Canada. U.S. Pat. 1,202,085, Oct. 24, 1916. Date of appl., Oct. 26, 1914.

The nitroglycerin and the acid mixture by means of which it was produced are introduced into a tank containing a large excess of acid mixture and water, which becomes saturated with nitroglycerin. The mixture in the tank may consist of sulphuric and nitric acids in the proportion of about 9:1, with about twice the volume of water, so as to form a liquid of sp.gr. about 1.3; or it may consist of sulphuric acid with about the same amount of water and about 5% of nitric acid. The separated nitroglycerin is drawn off from the bottom of the tank, whilst part of the acid liquid is periodically withdrawn at a point above the level of the nitroglycerin and replaced by water to compensate for the alteration in the proportions caused by the introduction of further quantities of nitroglycerin and acid.—C. A. M.

**Matches:** Ignitable compound for —. G. Jonas, Brussels, Belgium. U.S. Pat. 1,201,191, Oct. 10, 1916. Date of appl., Mar. 25, 1912.

POWDERED barium chlorate, with or without a cuprous compound insoluble in water, is incorporated with the other non-adhesive constituents of the paste, and the mass mixed with water and with the adhesive constituents.—C. A. M.

**Explosives.** T. Hawkins, Balmain, Assignor to Powerite Explosive Co., Ltd., Sydney, N.S.W. U.S. Pat. 1,202,712, Oct. 24, 1916. Date of appl., Nov. 11, 1915.

See Eng. Pat. 18,505 of 1915; this J., 1916, 656.

### XXIII.—ANALYSIS.

**Soda-lime:** A new tube for —. A new absorbent for carbon dioxide in steel analysis. G. L. Kelley. J. Ind. Eng. Chem., 1916, 8, 1038—1039.

THE soda-lime tube is 5 in. high and 1 in. internal diameter, enlarged at the bottom to form a flat base,  $1\frac{1}{2}$  in. internal diameter. A capillary tube passes through the side, where it is sealed in, at a height of 2 in., and inside the tube is bent at right angles and extends down the centre to within  $\frac{1}{2}$  in. of the base. The tube is closed at the top by a rubber stopper carrying a piece of capillary tubing. A small amount of absorbent cotton is placed at the bottom of the tube under the end of the capillary tube, then a  $\frac{1}{4}$  in. layer of calcium chloride, and another thin layer of cotton. The tube is nearly filled with soda-lime, which is covered by a third layer of cotton.

A new absorbent for carbon dioxide, termed "soda asbestos" is prepared by mixing a solution of 500 grms. of sodium hydroxide in 500 c.c. of water with 1 kilo. of pulverised sodium hydroxide, and adding shredded asbestos gradually, with stirring, until the mixture appears not to be capable of wetting more asbestos. The mass is heated at 150°—180° C. for 4 hours, with addition of more asbestos from time to time, then cooled and ground till most of it passes a 10-mesh sieve. A quantity of this absorbent sufficient to fill the tube described above, will absorb 8—10 grms. of carbon dioxide.—A. S.

**Gas analysis:** Reagents for use in —. V. Relative advantages of use of sodium and potassium hydroxides in the preparation of alkaline pyrogallol. R. P. Anderson. J. Ind. Eng. Chem., 1916, 8, 999—1001. (See also Anderson, this J., 1916, 859; Shipley, 1916, 1003.)

The author summarises the available information as to the relative advantages and disadvantages of sodium and potassium hydroxides for the pre-

paration of the alkaline pyrogallate reagent, and concludes that the potassium reagent is superior in regard to time for complete absorption and ease of manipulation, whilst the sodium reagent is better in regard to cost of materials and specific absorption. The saving of time by using the potassium reagent, however, far outweighs the advantage due to the lower cost of the sodium reagent, even with the present abnormal price of potassium hydroxide.—A. S.

**Lead molybdate:** Physical character of precipitated — and its importance in the determination of molybdenum and lead. H. B. Weiser. J. Phys. Chem., 1916, 20, 640—662.

LEAD molybdate, precipitated from ammonium molybdate solution by the addition of lead nitrate solution, is more granular and much less bulky than when lead acetate solution is used as the precipitant; the precipitate obtained with lead acetate may, however, be rendered granular by adding a small amount of nitric acid to the ammonium molybdate solution. Freshly precipitated lead molybdate is fairly soluble in nitric acid, and slightly soluble in ammonium acetate and sodium acetate solutions, but the solvent action of the small amount of nitric acid used, to obtain the precipitate in a condition suitable for filtration may be counteracted by subsequent neutralisation. In the presence of an excess of ammonium molybdate, lead molybdate forms a colloidal solution; the addition of nitric acid reprecipitates the lead molybdate. To determine molybdenum in a soluble molybdate, a quantity of the salt corresponding to about 0.4 gm.  $\text{MoO}_3$ , is dissolved in 180 c.c. of water, a few drops of nitric acid are added, and, to the boiling solution, 4% lead nitrate solution is added, drop by drop, until the addition of a further drop causes the milky mixture to become visibly clearer. The boiling is continued for another 3 mins., another drop, or more, of lead nitrate solution is added, followed by ammonia until the mixture is neutral to litmus paper. The precipitate is collected, washed with 2% ammonium nitrate solution, dried above 100° C., and ignited at a dull red heat, and weighed.  $\text{PbMoO}_4 \times 0.2616 = \text{Mo}$ . This method may be used, conversely, for the determination of lead.—W. P. S.

**Viscosity of very viscous substances:** Method of measuring the —. A. L. Feild. U.S. Bureau of Mines, 1916. Techn. Paper 157. Met. and Chem. Eng., 1916, 15, 541.

THE method—originally devised for measuring the viscosity of blast-furnace slags at temperatures up to 1600° C., but also applicable to glass, asphalt, pitch, varnishes, clay slips, etc.—is based on the fact that when the outer of two concentric cylinders separated by a liquid is rotated at a constant angular velocity, a torque proportional to the viscosity of the liquid is exerted upon the inner cylinder. This torque is measured accurately by suspending the inner cylinder by means of a calibrated steel or phosphor-bronze suspension, and at the same time weighting and damping the suspended system so that its motion about its axis of rotation obeys laws similar to those governing the motion of a damped d'Arsonval galvanometer. The liquid under observation is subjected to a uniform shear, without deformation; and a single run with the apparatus furnishes data for a temperature-viscosity curve over the desired range. Extreme accuracy in reading is obtained by means of a mirror and galvanometer scale, but for many practical purposes a pointer and graduated arc are sufficiently precise. The results may be expressed in terms of specific viscosity referred to that of water, or in terms of absolute C.G.S. units.—W. E. F. P.

*Organic liquids; Application of the method of constant boiling-point mixtures to the qualitative analysis of certain mixed.*—W. R. G. Atkins. Analyst, 1916, 41, 334—335.

In the case of certain mixtures it is difficult, if not impossible, to purify a constituent so that its identity may be established by a determination of its boiling point. It is possible, however, to add another liquid with which the unknown liquid will form a mixture of constant boiling point, and so identify a small amount of it in a mixture. A list of such mixtures, their boiling points and compositions, may be found in Young's "Fractional Distillation." For example, to ascertain the composition of a mixture smelling of alcohol, a small quantity of pure benzene was added and the mixture distilled from a flask fitted with a Young's still head. The temperature rose rapidly to the boiling point of the binary mixture of methyl alcohol and benzene (58-35° C.) and halted there for some time. Thus the presence of methyl alcohol was established. There was another slight halt in the temperature rise at 64-8° C. (ethyl alcohol, benzene, water), a slight turbidity appearing in the column, followed by a rise to 68-25° C. (benzene and ethyl alcohol), and then to 78-3° C. (ethyl alcohol). The mixture in question therefore consisted of methyl and ethyl alcohols with a trace of water. Again, the presence of a small amount of methylethyl ketone in a mixture of acetone and benzene was detected by distilling off most of the acetone, adding a small quantity of water, and continuing the distillation. A fraction distilled at about 73° C., the boiling point of the constant-boiling mixture of methylethyl ketone and water. Other instances are given indicating that the method is applicable to a wide range of mixtures.—W. P. S.

*Discrimination between the two naphthols by the titanil sulphate reagent.* Denigès. See III.

*Rapid volumetric determination of indigo.* Jones and Spaans. See IV.

*Method for determining the strength of paper when wet.* Reed. See V.

*Proposed registering apparatus for the determination of the excess of oxygen in the exit gases from lead chambers in the manufacture of sulphuric acid.* Pérégriu. See VII.

*Separation of hydrofluoric and hydrofluosilicic acids.* Dinwiddie. See VII.

*Determination of grog and clay in unburned fire-bricks.* Lessing. See VIII.

*Thermal conductivity of materials employed in furnace construction.* Griffiths. See VIII.

*Analysis of tin ores.* Golick. See X.

*Viscosity of beeswax and its adulterants.* Fabris. See XII.

*Errors in the determination of acid values of boiled oils and varnishes.* Ware and Christman. See XIII.

*Comparison between agar and gelatin as media for the plate method of counting bacteria.* [Bacteriological examination of soils.] Conn and Dotterer. See XVI.

*Method of extraction as affecting the determination of phosphoric acid in soils.* Hale and Hartley. See XVI.

*Determination and distribution of moisture in bread.* Wessling. See XIXa.

*Number of colonies allowable on satisfactory agar plates.* [Bacteriological examination of milk.] Breed and Dotterer. See XIXa.

*Polarimetric determination of sugar [sucrose] in condensed milk.* Brooks. See XIXa.

*Determination of sugar in meat products, particularly extracts.* Smith. See XIXa.

*Determination of strychnine in Nux vomica.* Jensen. See XX.

*General reaction of vegetable or animal alkaloids of phenolic function (morphine and derivatives, cupreine, adrenaline, etc.).* Denigès. See XX.

*Determination of vanillin in vanilla extract.* Dox and Plaisance. See XX.

*Determination of salol and acetanilide and of salol and phenacetin in mixtures.* Salkover. See XX.

*A modification of Martens' density meter [polarisation photometer].* Goldberg. See XXI.

#### PATENTS.

*Depth of colour of various substances, liquid or solid; Apparatus for measuring.*—G. G. Scurfield, Sunderland. Eng. Pat. 16,876, Dec. 1, 1915.

A TINTOMETER is used in which the observation tubes dip into the liquids which are being compared. It consists of a stand carrying an adjustable mirror reflecting light into two observation tubes carried by a block fixed to the upper part of a graduated telescopic upright pillar. One observation tube dips into a larger tube with glass bottom resting on a glass plate supported by the stand just above the mirror. This outer tube contains one of the liquids to be compared; the depth of liquid used is adjusted by movement of the upper part of the upright pillar and is read off on the scale in any suitable units. The other liquid is contained in a smaller glass-bottomed tube fixed to the other observation tube and is of fixed depth or adjustable only between narrow limits. The instrument may be monocular in which case the observation tubes converge upwards; or binocular when they are parallel. The calibration of the scale will depend on the particular use for which the instrument is intended. In one example the scale shows the amount of caramel to be added to a given quantity of the tested liquid to produce the required tint.—B. V. S.

*Mechanism for determining the viscosity of paper stock.* U.S. Pat. 1,201,402. See V.

### Trade Report.

#### Contraband of War.

A ROYAL PROCLAMATION, dated November 23rd, 1916, made the following additions to, and amendments in, the ~~contraband list~~:

The following articles are now declared absolute contraband:—Silk in all forms and the manufactures thereof, silk cocoons. Artificial silk and the manufactures thereof. Quillaia bark. Zirconium, cerium, thorium, and all alloys and compounds thereof. Zirconia and monazite sand.

The following alteration is made in the contraband order of October 14th, 1915:—

For item 4, "emery, corundum, natural and artificial (alundum) and carborundum in all forms," there shall be substituted "emery, corundum, carborundum, and all other abrasive materials, whether natural or artificial, and the manufactures thereof."

Glue, gelatin, and substances used in the manufacture thereof are to be treated as conditional contraband.

*New cyanide works in Glasgow.* Pharm. J., Nov. 25, 1916.

It is announced that the Cassel Cyanide Co. is erecting large works in Glasgow for the production of cyanides on an extended scale. The company has fixed a contract, extending over five years, to supply the whole of the cyanide requirements of the gold mines of South Africa.

